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Hsieh

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(54) **LAN CONNECTOR WITH UNLOCKING PREVENTING MECHANISM**

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CPC H01R 13/6271; H01R 13/6275; H01R 13/6272
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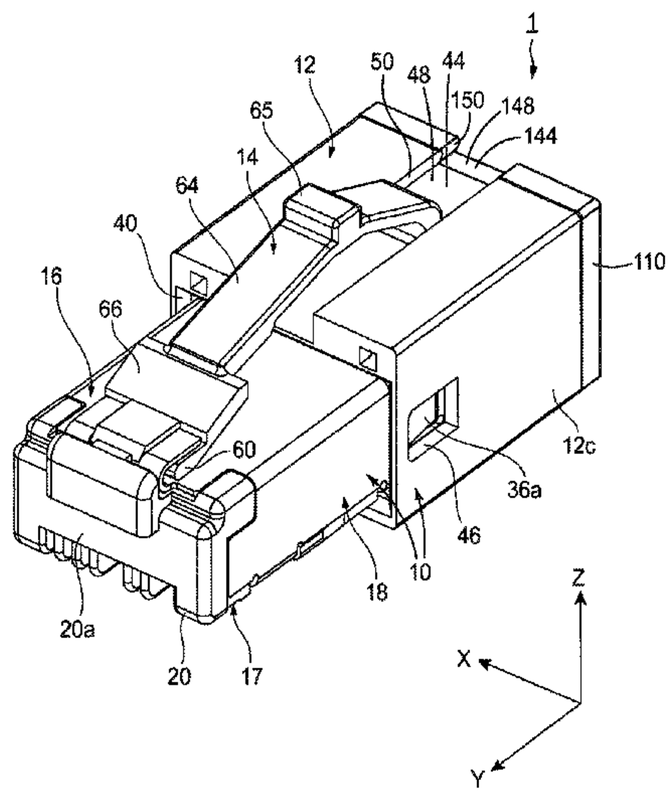
(57) **ABSTRACT**

A connector including a first channel, a latching member and a second channel. A portion of the latching member is slidably attached to the first channel. The second channel is configured to align with the first channel or to misalign with the first channel. When the second channel is aligned with the first channel, the latch member is allowed to latch with and unlatch from a mating connector. When the second channel is misaligned with the first channel, the latching member is prevented from latching with and unlatching from a mating connector.

32 Claims, 13 Drawing Sheets



(51) **Int. Cl.**
H01R 13/506 (2006.01)
H01R 24/64 (2011.01)

(58) **Field of Classification Search**
USPC 439/352, 354
See application file for complete search history.

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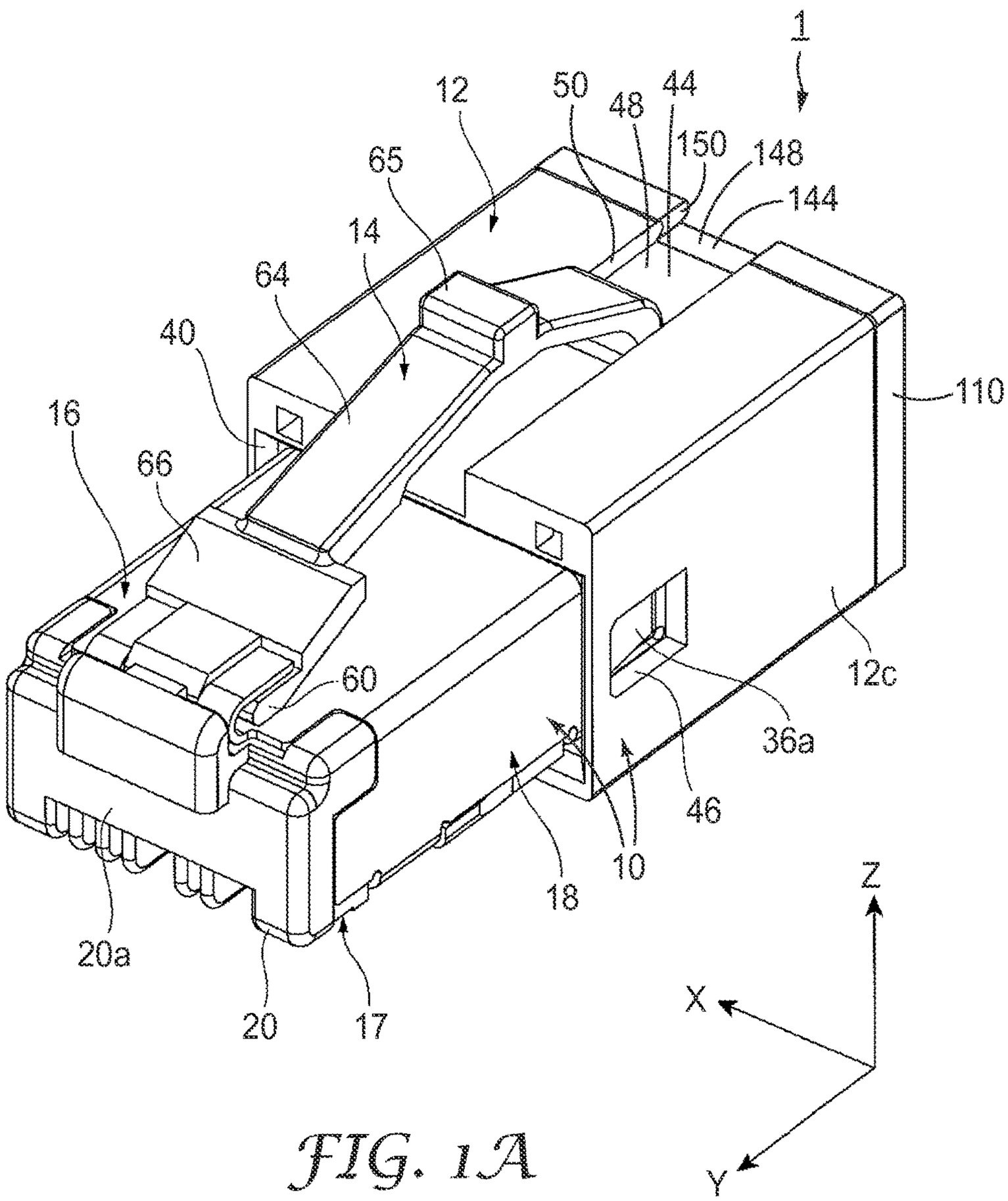

1
12
50
48
44
150
148
144
65
14
64
40
110
16
66
60
12c
36a
46
10
18
20a
20
17
Z
X
Y

FIG. 1A

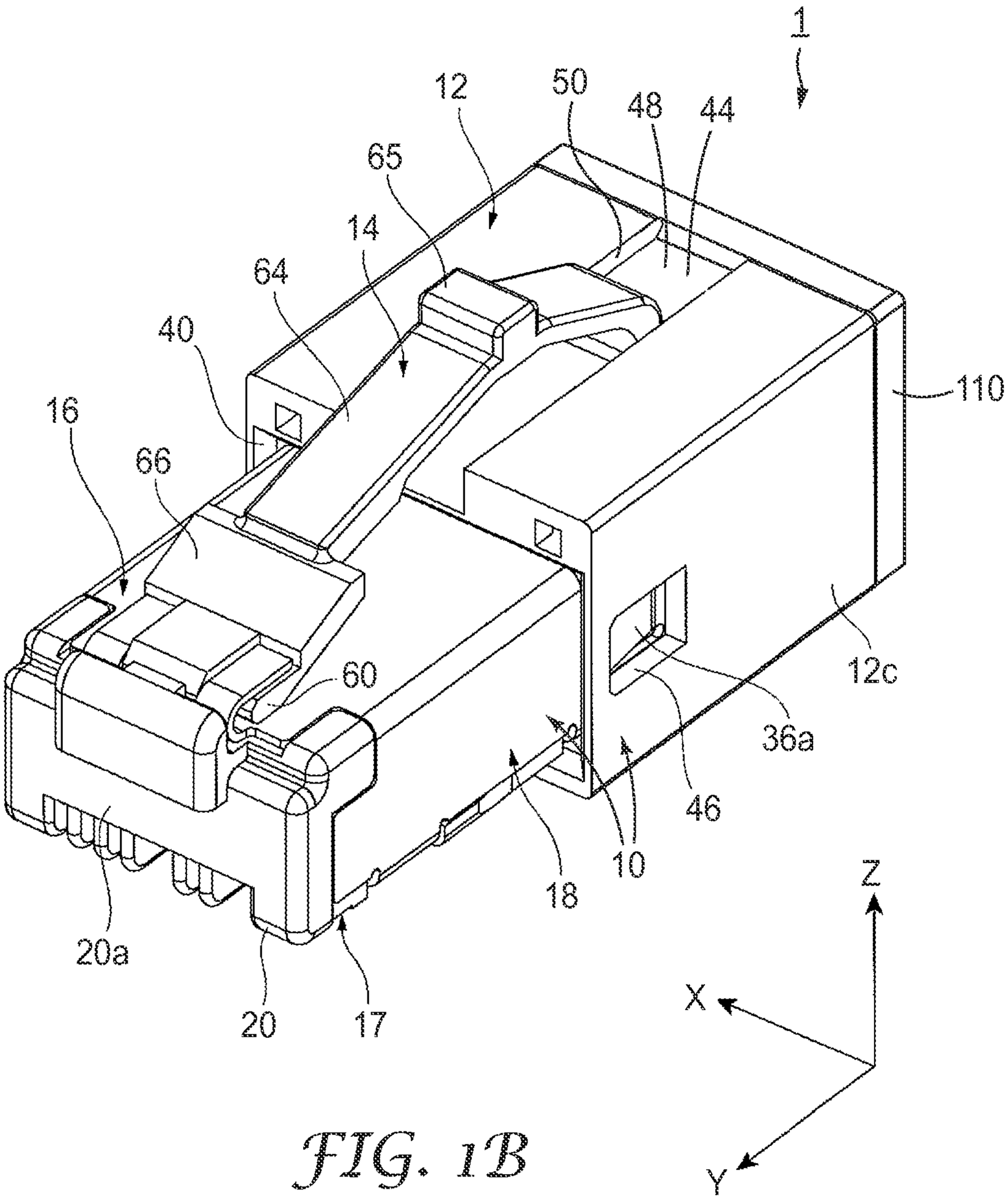


FIG. 1B

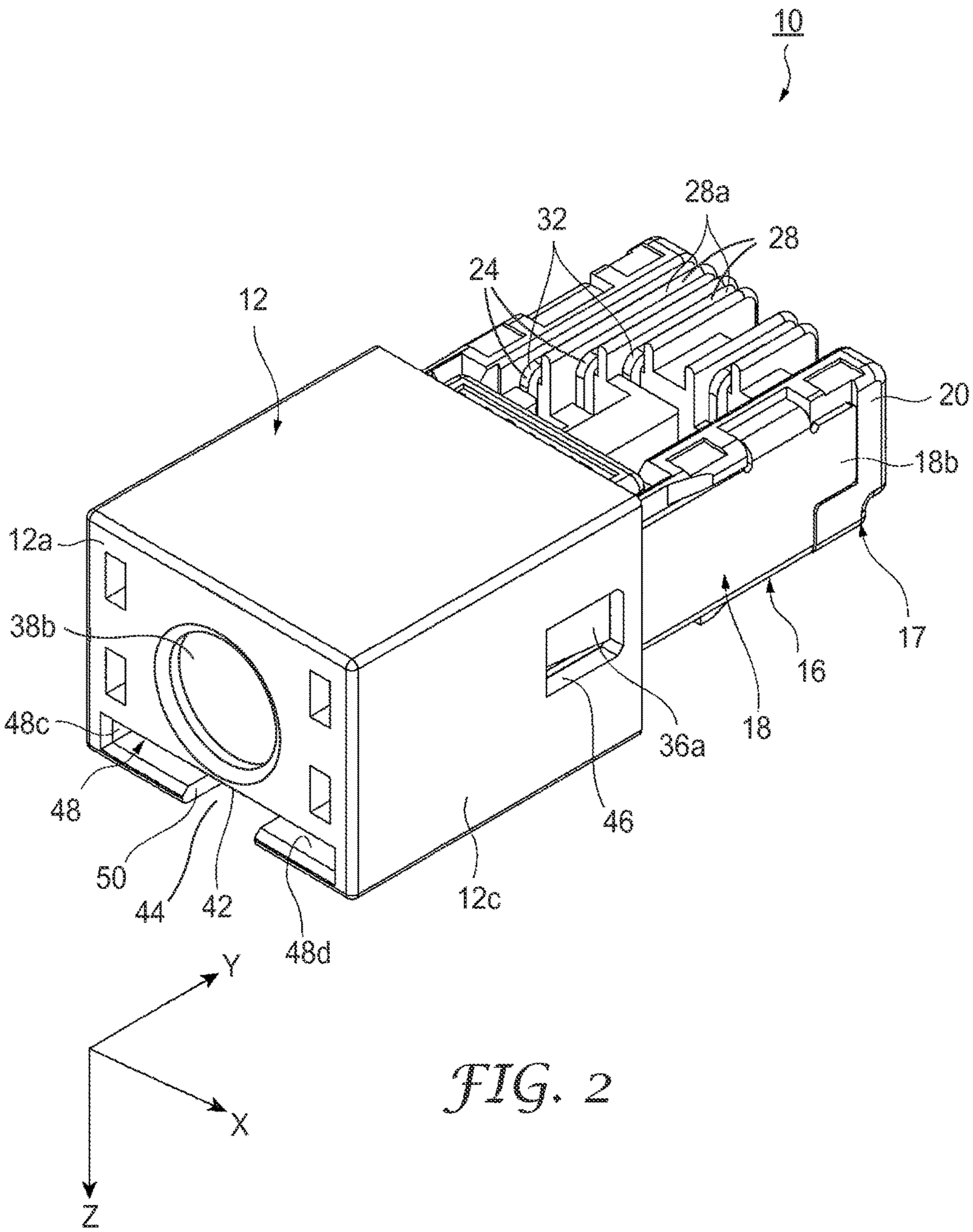

10
28a
32
28
24
12
20
18b
12a
38b
48c
48
50
44
42
48d
12c
46
36a
18
16
17
Y
X
Z

FIG. 2

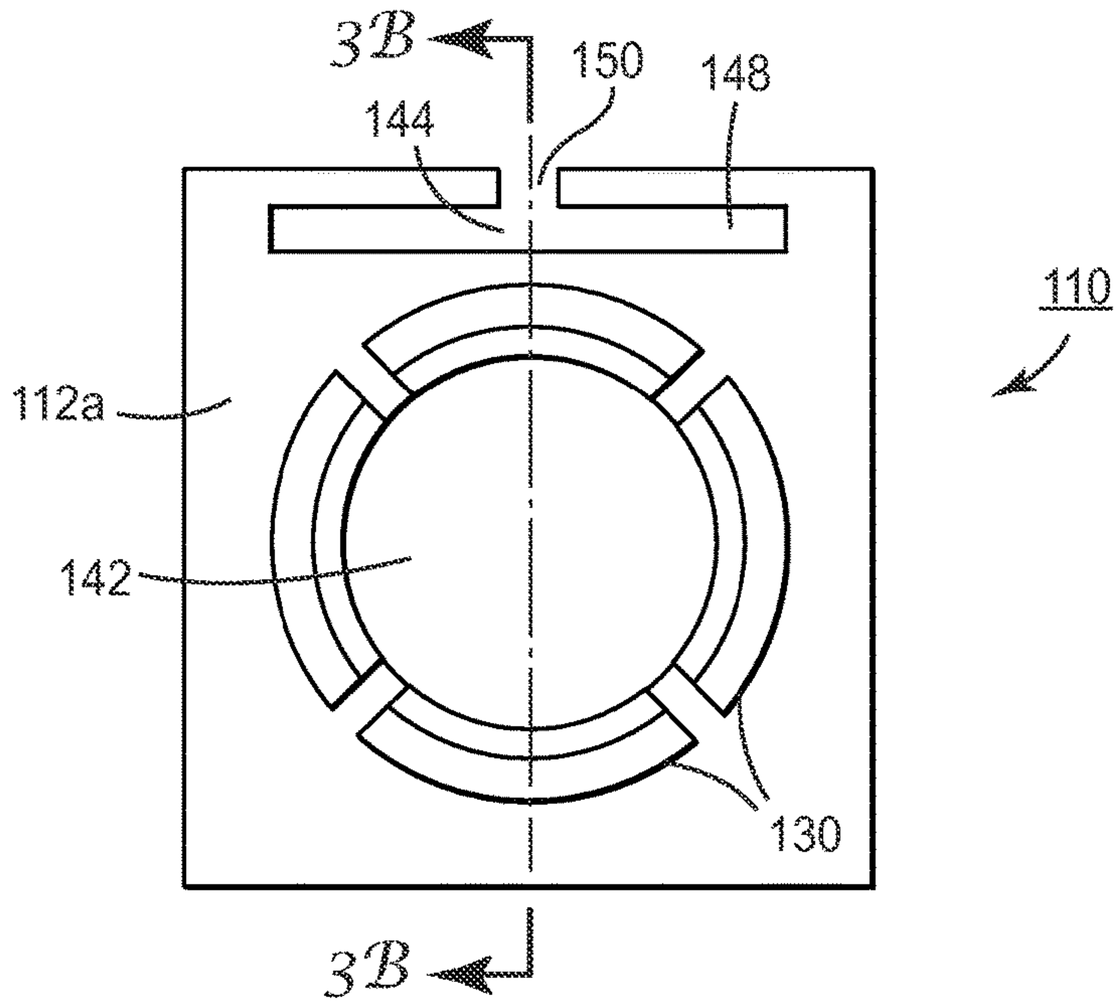


FIG. 3A

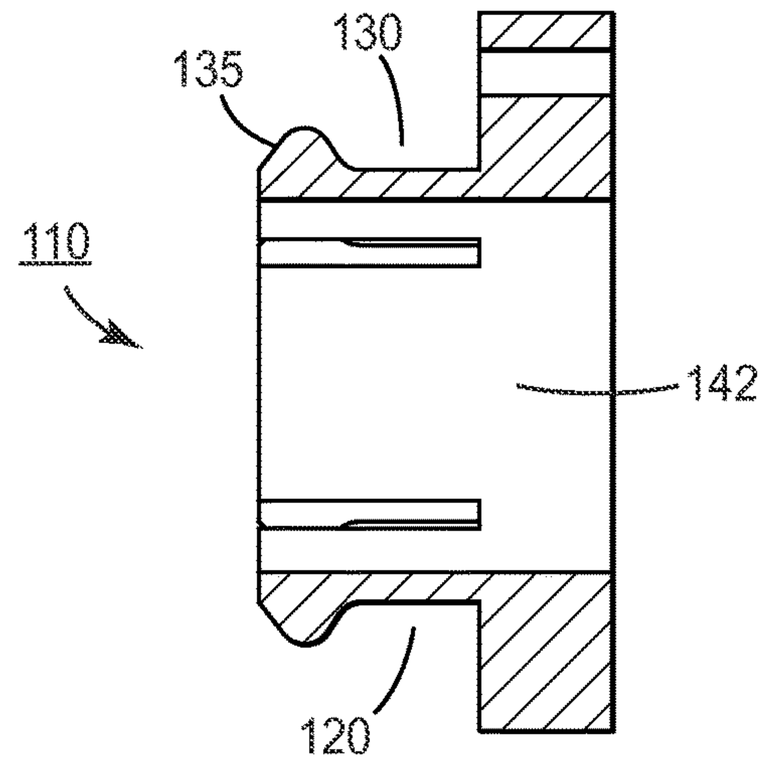


FIG. 3B

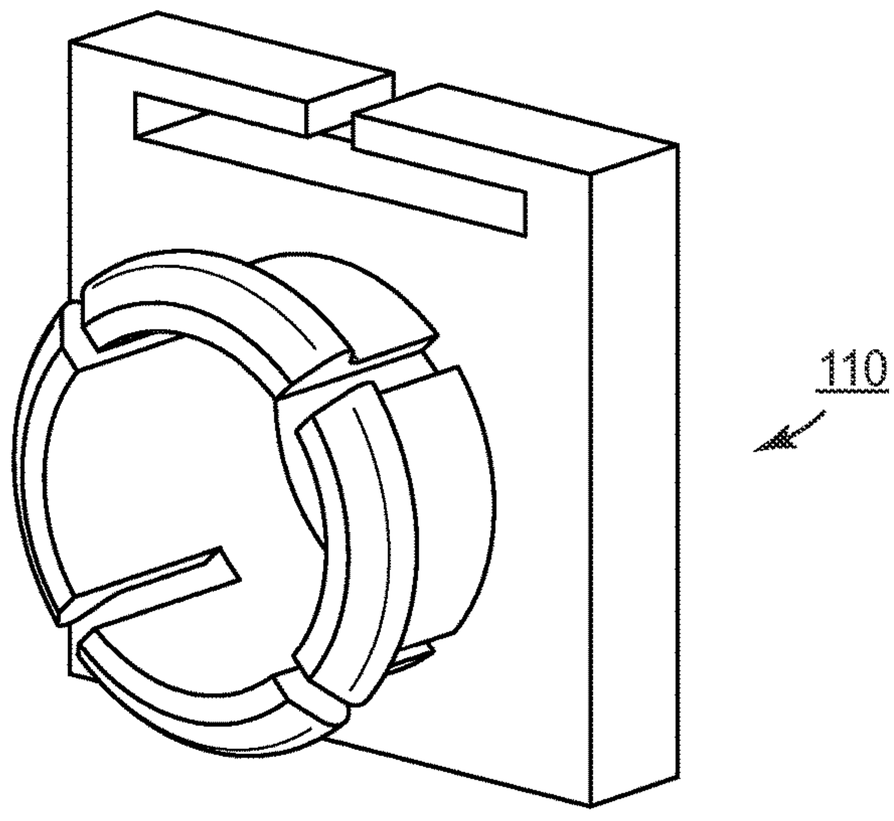


FIG. 3C

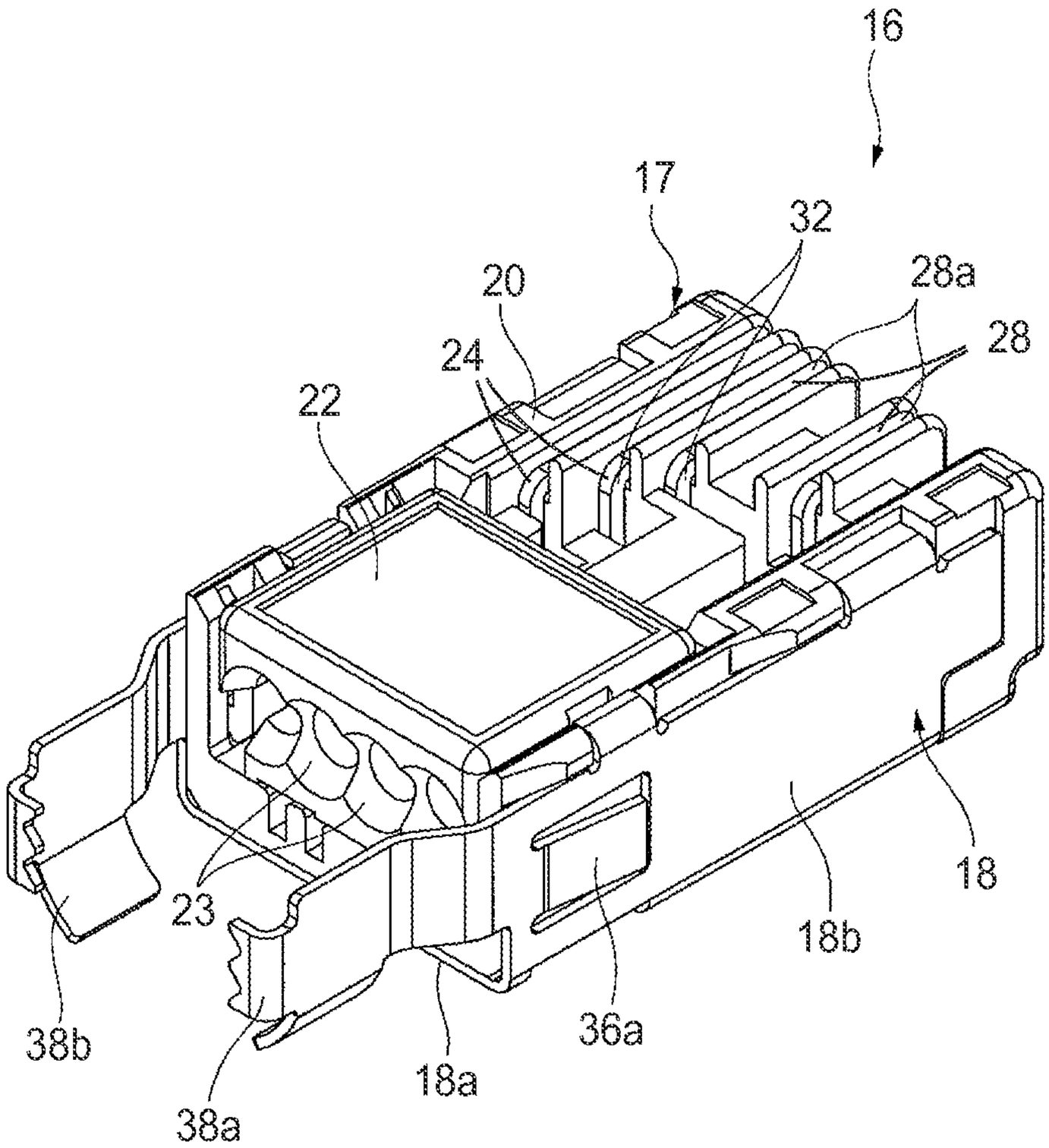


FIG. 4

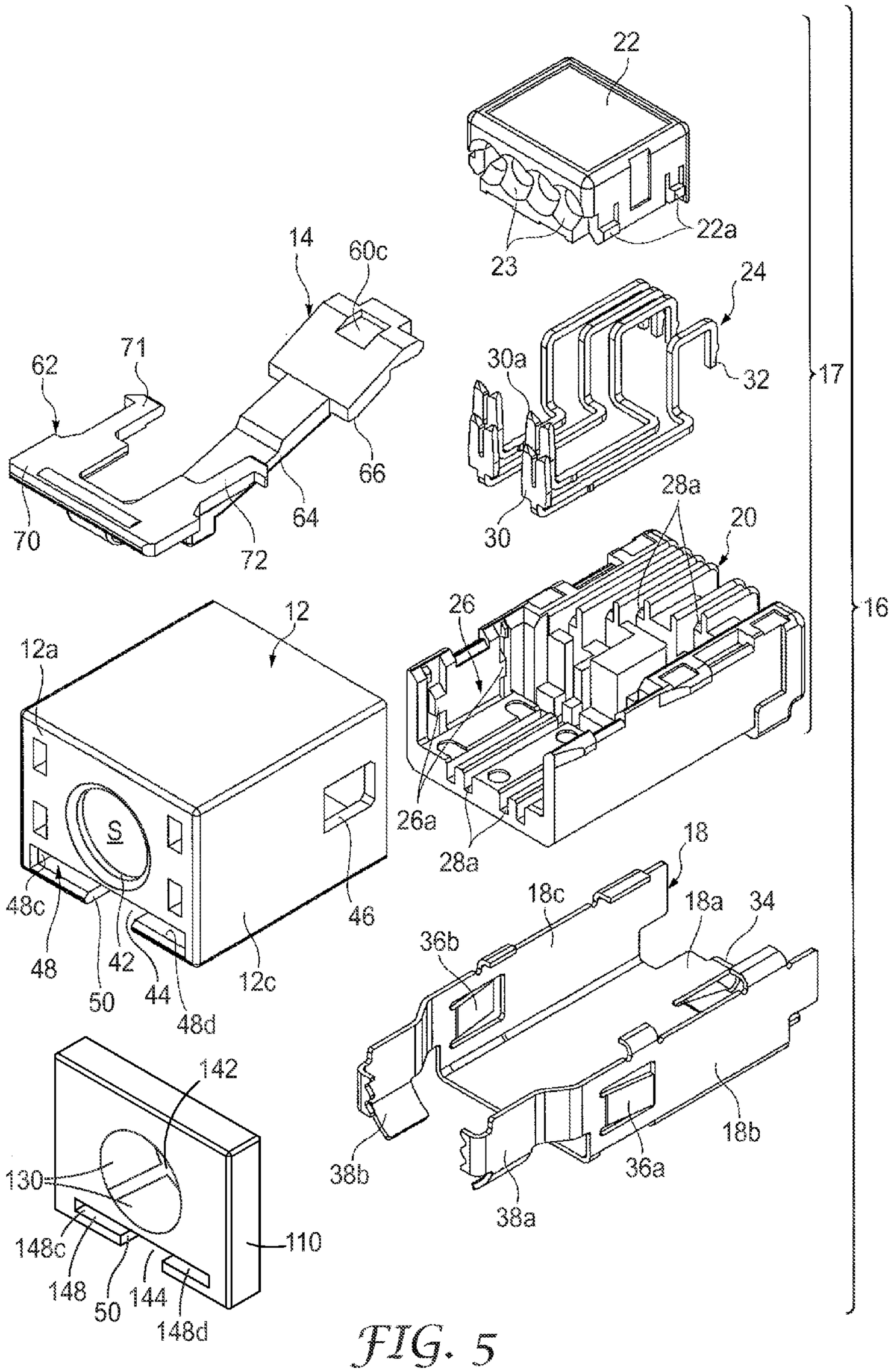
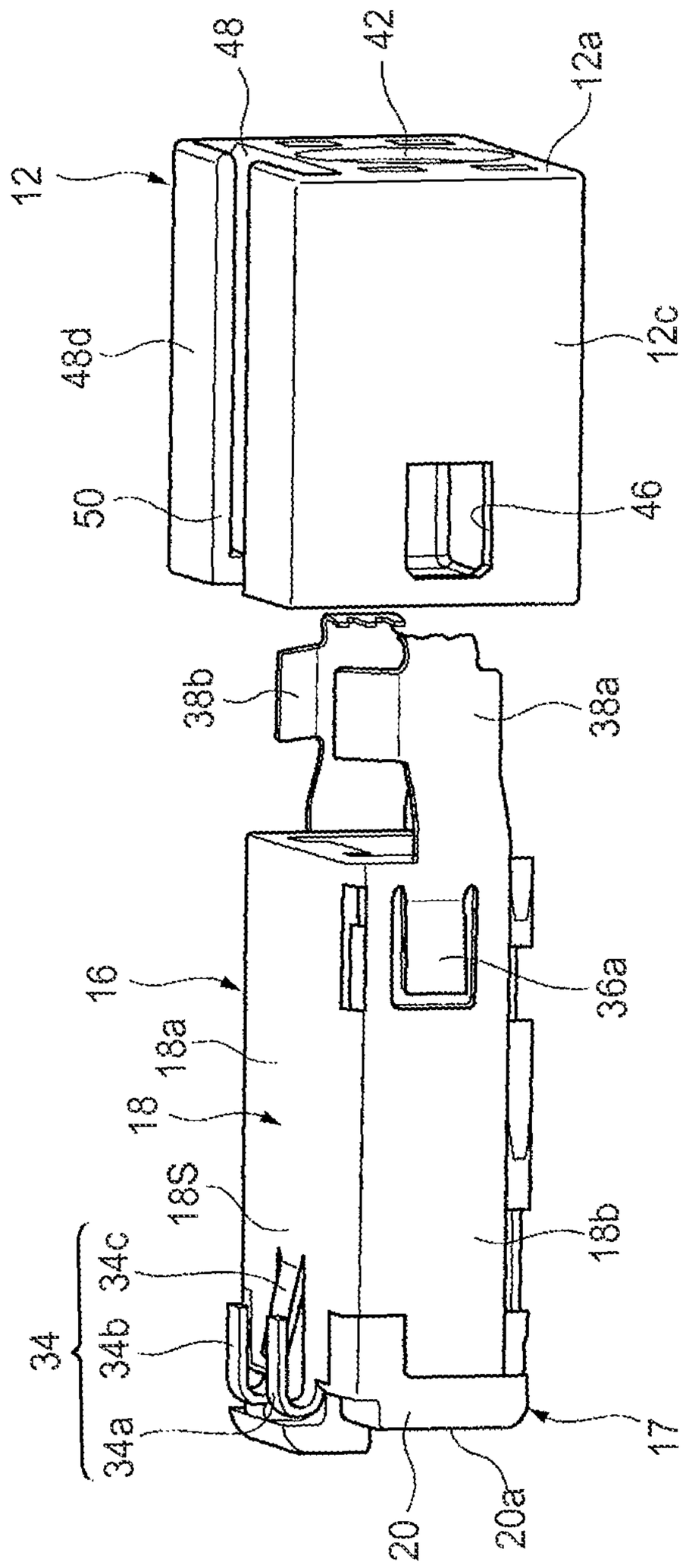

22
22a
23
24
30a
32
17
14
60c
62
71
66
64
70
72
30
28a
20
26
16
12
12a
S
26a
28a
18
18c
18a
34
36b
48c
46
48
42
50
44
12c
48d
18b
38b
36a
38a
142
130
148c
110
148
50
144
148d

FIG. 5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42
12a
12
48d
12c
50
46
38b
38a
16
36a
18a
18
18S
18b
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34c
34b
34a
17
20
20a

FIG. 6

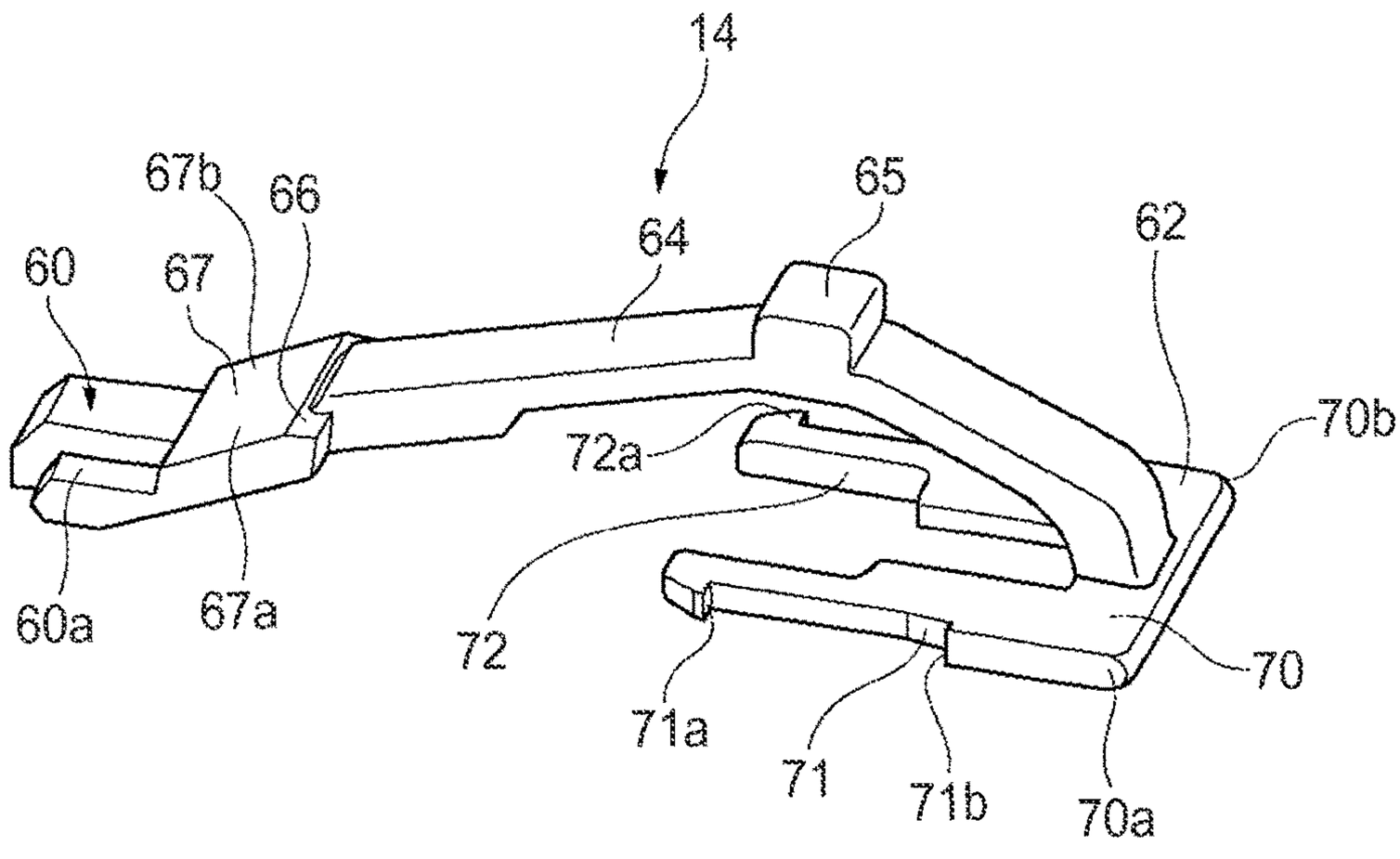

FIG. 7A

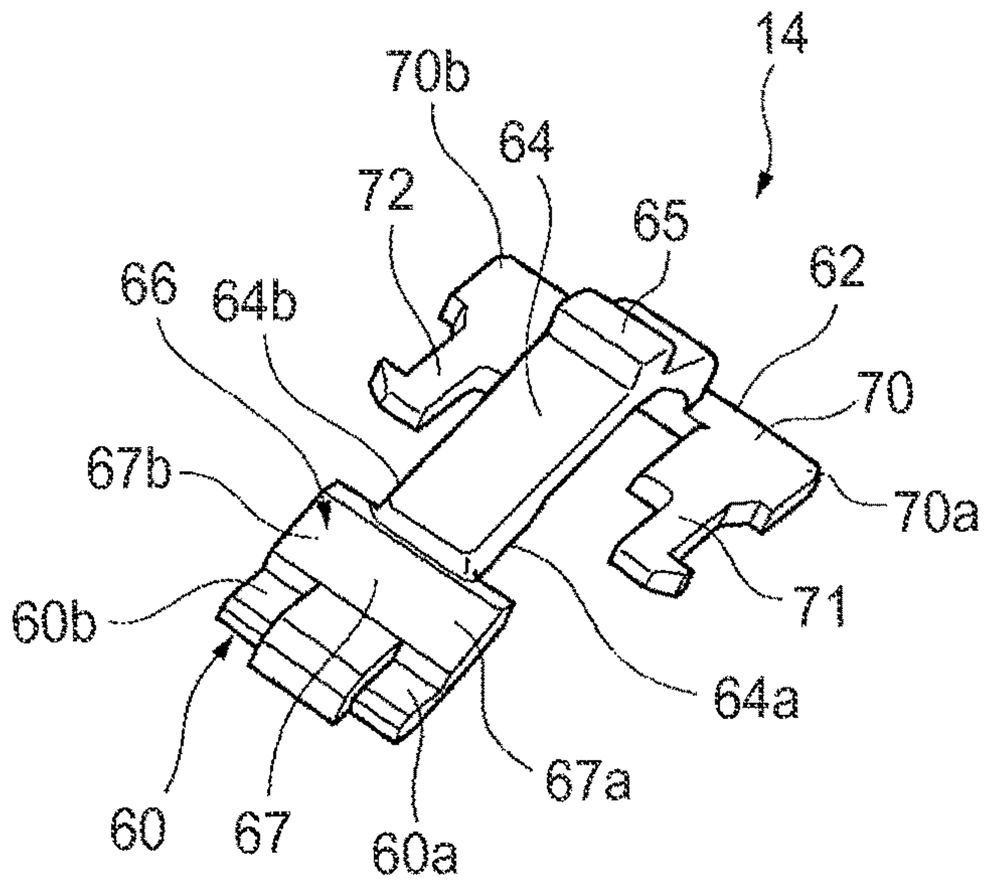
14
70b
64
72
65
62
66
64b
70
67b
70a
71
60b
64a
67a
60
67
60a

FIG. 7B

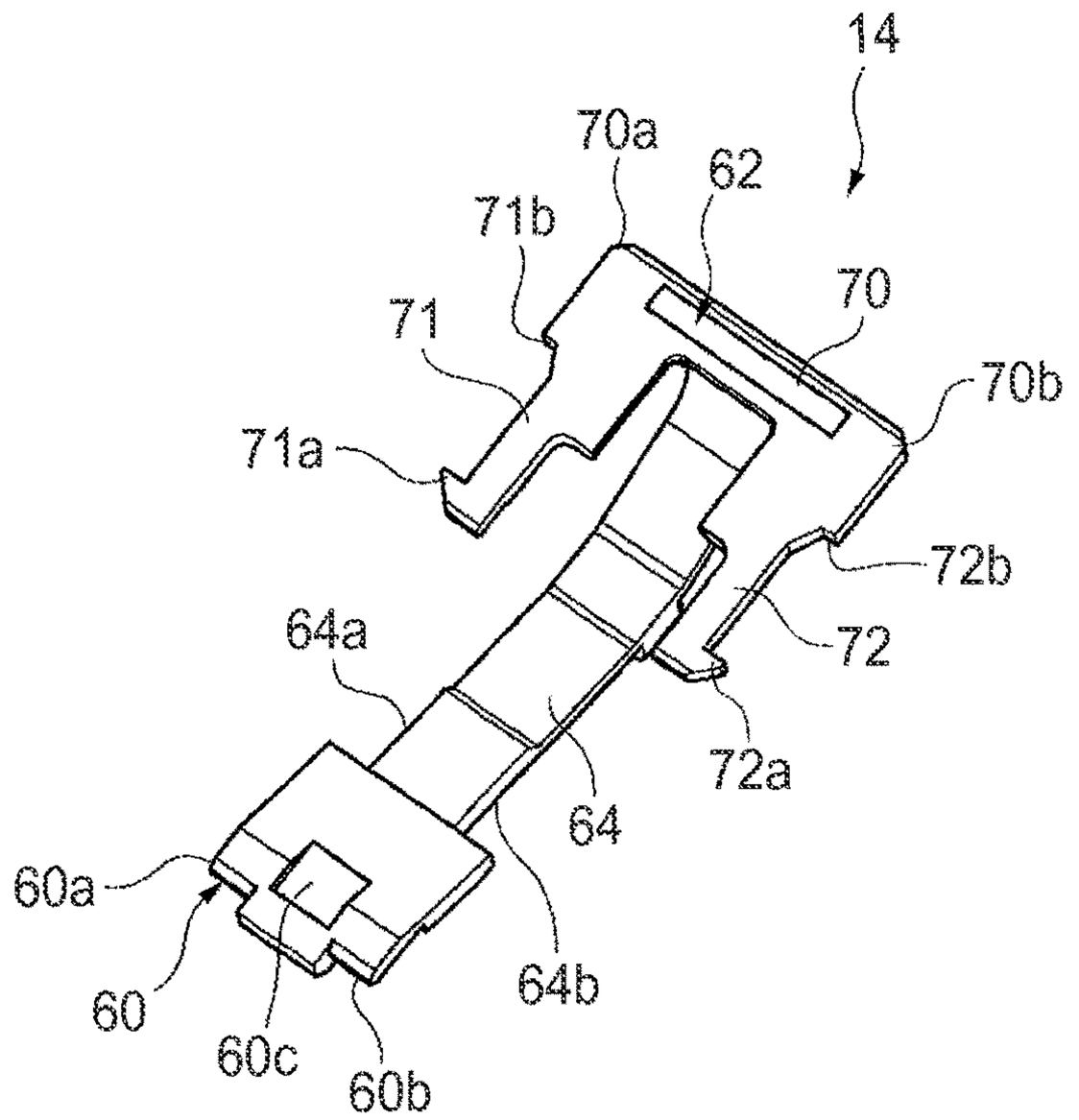
14
70a
62
71b
70
71
70b
71a
72b
64a
72
72a
64
60a
64b
60
60c
60b

FIG. 7C

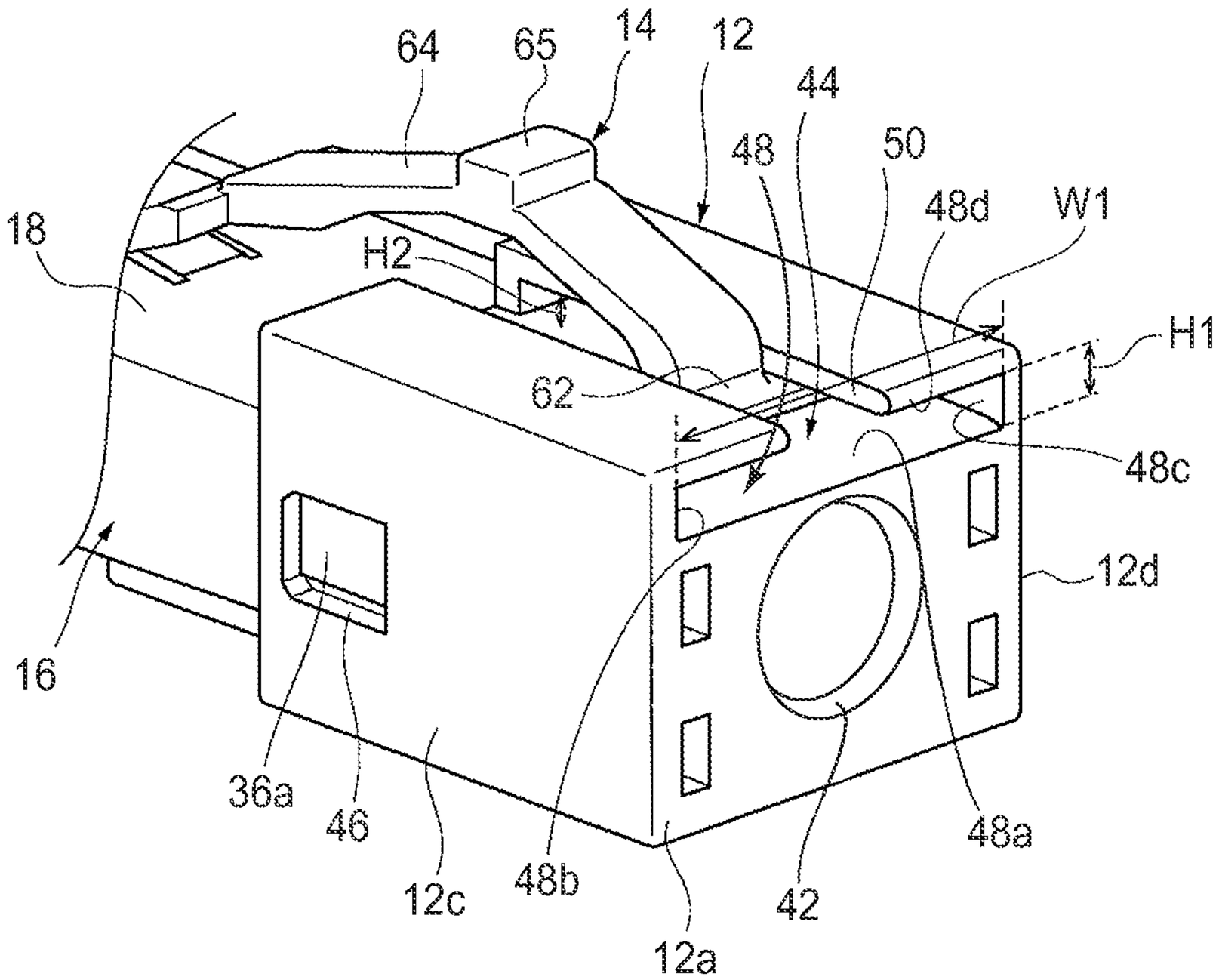
64
65
14
12
44
48
50
48d
W1
18
H2
H1
62
48c
12d
16
36a
46
12c
48b
42
48a
12a

FIG. 8A

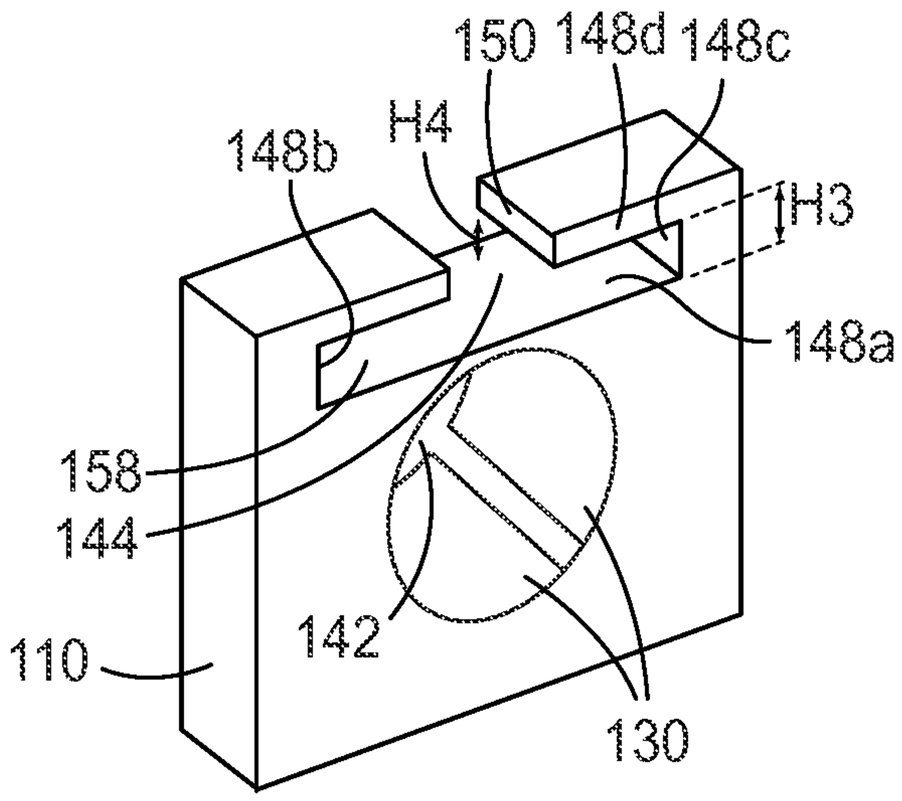
150
148d
148c
H4
148b
H3
148a
158
144
142
110
130

FIG. 8B

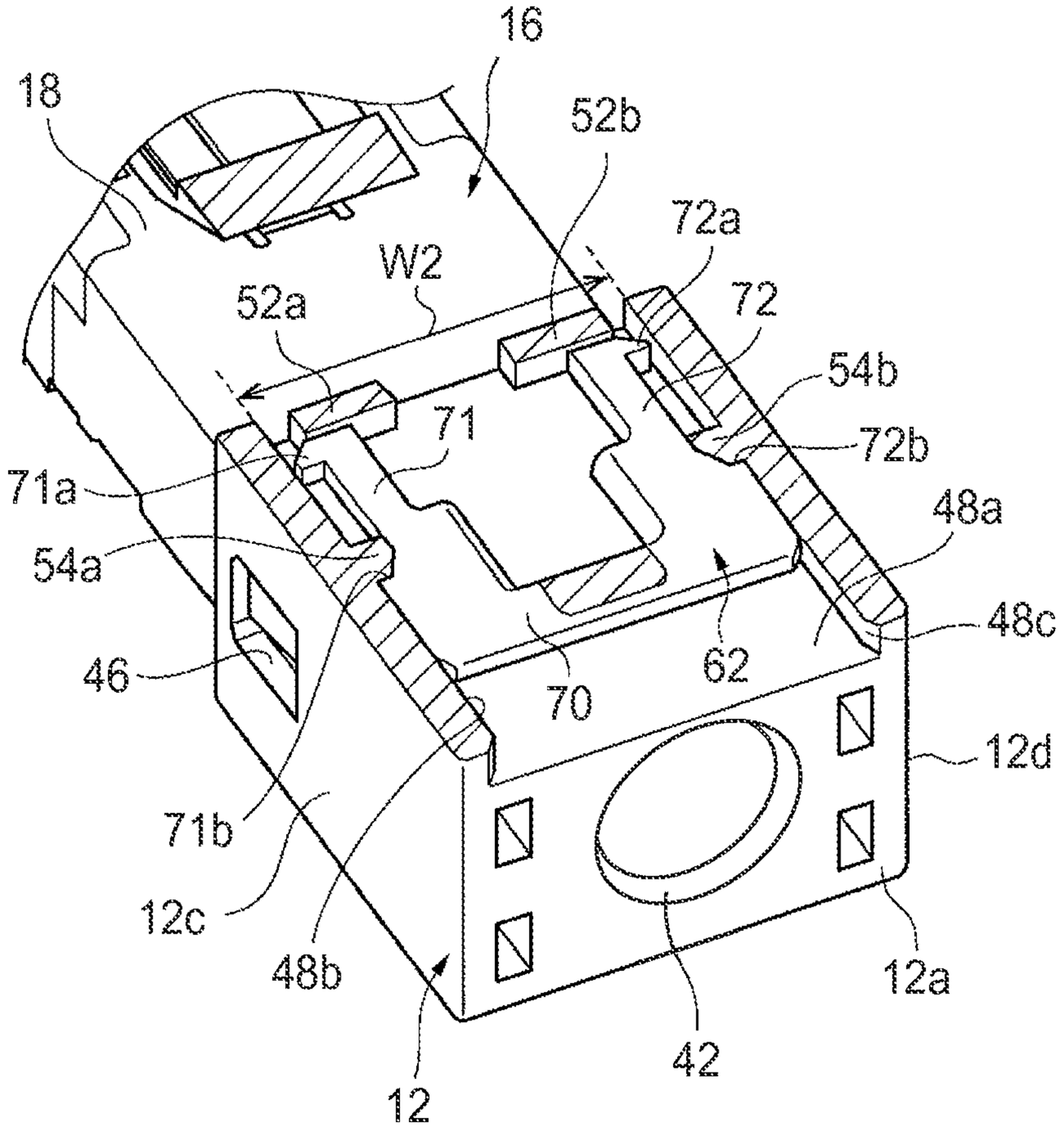
16
18
52b
72a
W2
52a
72
54b
71
72b
71a
48a
54a
48c
46
62
70
12d
71b
12c
48b
12a
42
12

FIG. 9

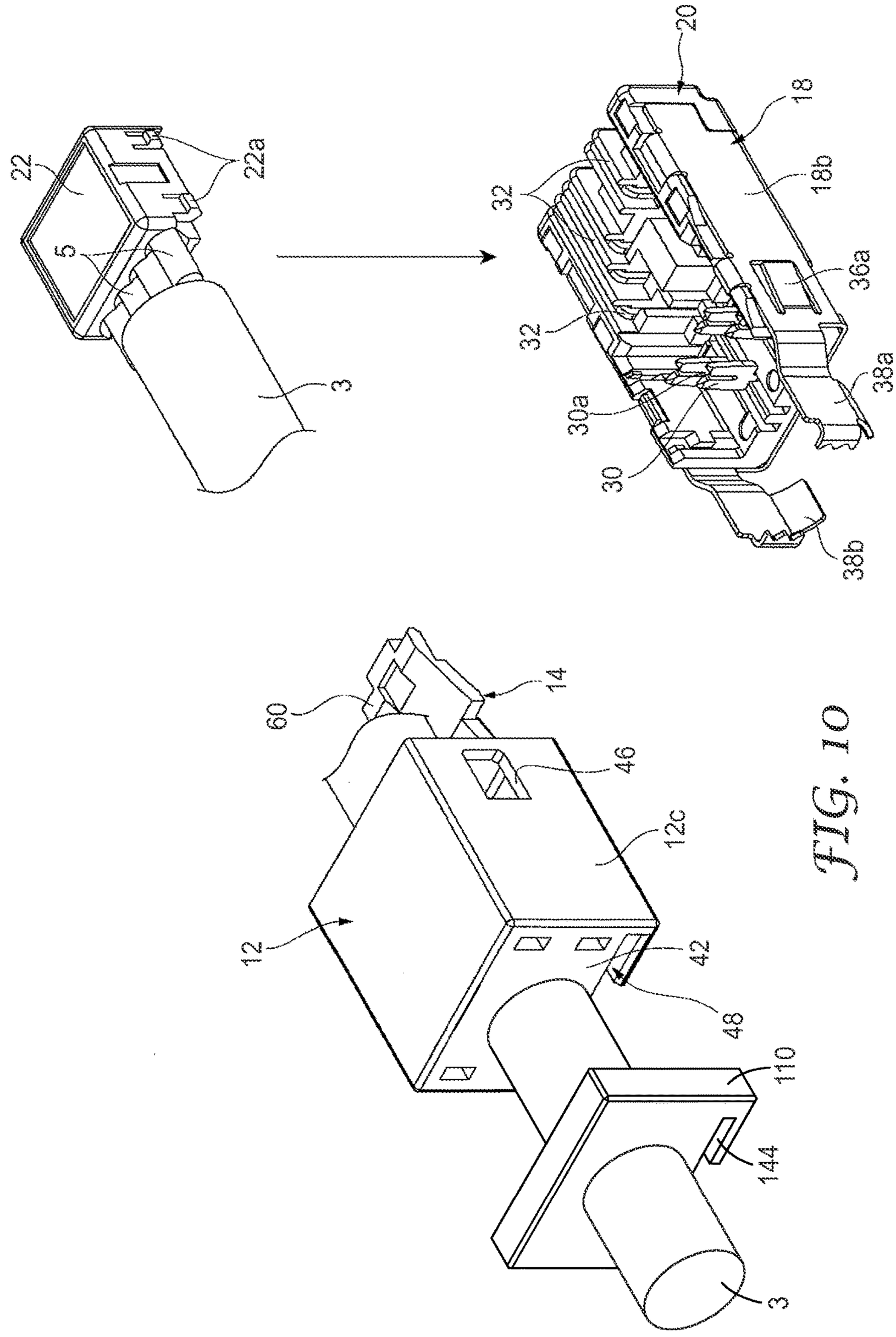
22
22a
5
3
20
18
18b
32
32
36a
38a
30a
30
38b
60
14
46
12c
12
42
48
110
144
3

FIG. 10

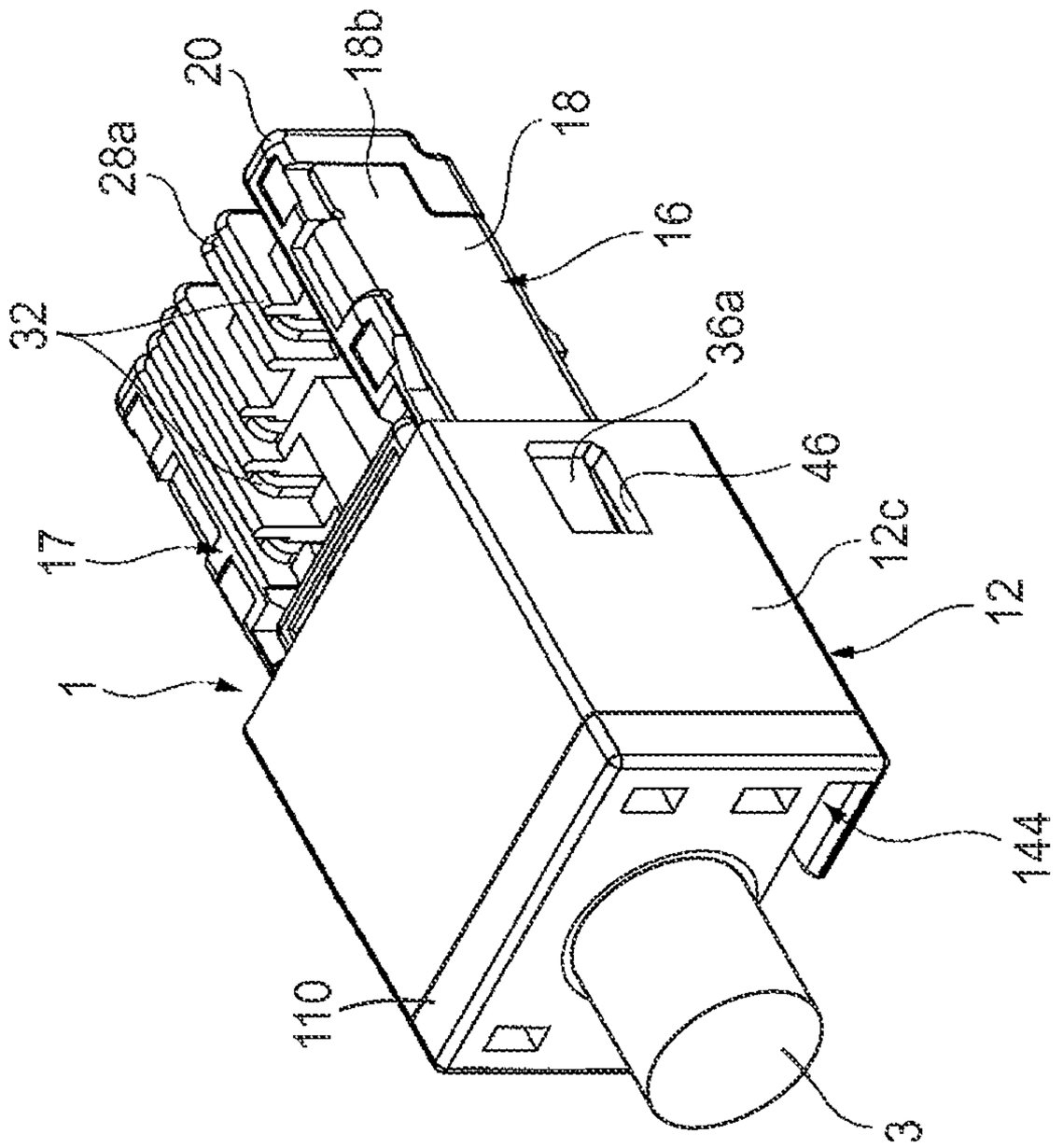

FIG. 11b

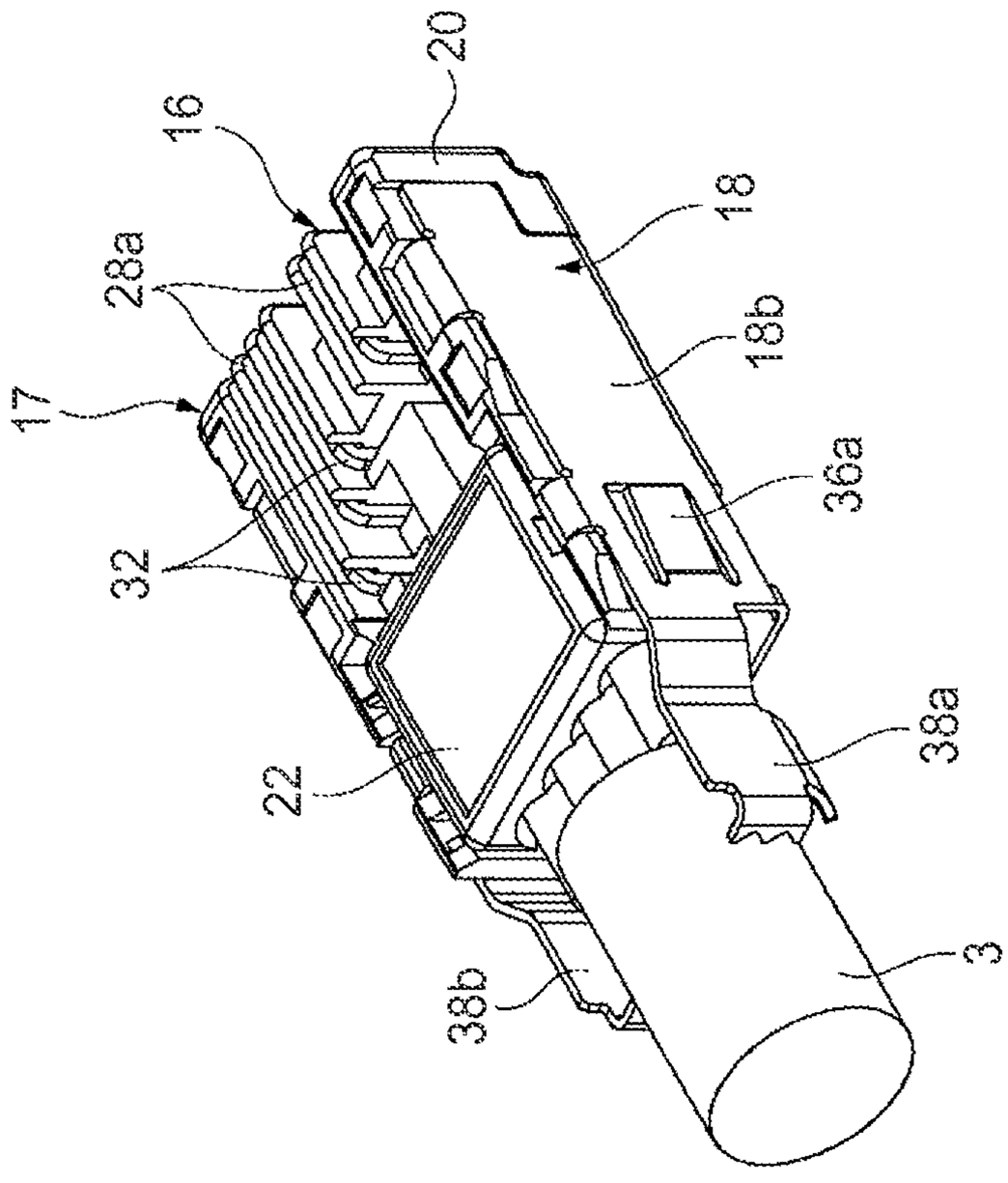

FIG. 11a

LAN CONNECTOR WITH UNLOCKING PREVENTING MECHANISM

BACKGROUND

Connectors, such as electrical connectors, are used to connect cables to various devices. Connectors are sometimes accidentally detached from a connected device. A need exists for a connector that prevents accidental detachment.

SUMMARY

In some aspects, a connector consistent with the present description includes a first body, a second body and a latching member. The first body includes a mating end of the connector for mating with a mating connector and a first channel extending along a mating direction of the connector. The second body includes a rear end of the connector opposite the mating end for receiving a cable and a second channel extending along the mating direction. The latching member is disposed along the mating direction and includes a fixed end fixedly attached to the connector body proximate the mating end, a sliding end slidably attached to the first channel proximate the rear end, and an elongated latching arm joining the fixed end to the sliding end. The connector also includes a latch portion extending from the latching arm for latching with and unlatching from a mating connector. The second body is configured to move relative to the first body between first and second states. When the second body is in the first state, the second channel is aligned with the first channel so that when the latching arm is pressed, the sliding end slides into the second channel allowing the latch portion to latch with and unlatch from a mating connector. When the second body is in the second state, the second channel is misaligned with the first channel, so that when the latching arm is pressed the sliding end is prevented from sliding into the second channel preventing the latch portion from latching with and unlatching from a mating connector.

In some aspects, a connector consistent with the present description includes a first channel, a latching member and a second channel. A portion of the latching member is slidably attached to the first channel. The second channel is configured to align with the first channel to form a continuous channel allowing the latch member to latch with and unlatch from a mating connector, and to misalign with the first channel preventing the latching member from latching with and unlatching from a mating connector. The connector may be an electrical connector or a fiber optic connector. The connector may include a first body, which includes the first channel, and a second body, which includes the second channel, adjacent to the first body.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a perspective view of a connector having a second body in a first state;

FIG. **1**B is a perspective view of a connector having a second body in a second state;

FIG. **2** is a perspective view from a lower side of a portion of the connector depicted in FIG. **1**A;

FIG. **3**A is a front view of a second body of a connector;

FIG. **3**B is a cross-sectional view of a second body of a connector;

FIG. **3**C is a perspective view of a second body of a connector;

FIG. **4** is a perspective view of a portion of a connector;

FIG. **5** is an exploded perspective view of a connector;

FIG. **6** is a perspective view of a mating component and a connector case;

FIGS. **7**A, **7**B and **7**C are perspective views of a latching member;

FIG. **8**A is a perspective view of a portion of a connector from the rear side;

FIG. **8**B is a perspective view of a second body of a connector from the rear side;

FIG. **9** is a perspective view of a partial cross-section of a first body of a connector;

FIG. **10** illustrates procedures for assembling a connector; and

FIGS. **11**A and **11**B illustrate procedures for assembling a connector.

DETAILED DESCRIPTION

In the following description, reference is made to the accompanying set of drawings that form a part of the description hereof and in which are shown by way of illustration specific embodiments. The figures are not necessarily to scale. Unless indicated otherwise, similar features for one embodiment may include the same materials, have the same attributes, and serve the same or similar functions as similar features for other embodiments. Additional or optional features described for one embodiment may also be additional or optional features for other embodiments, even if not explicitly stated, where appropriate. It is to be understood that other embodiments are contemplated and may be made without departing from the scope or spirit of the present description. The following detailed description, therefore, is not to be taken in a limiting sense.

Unless otherwise indicated, all numbers expressing feature sizes, amounts, and physical properties used in the specification and claims are to be understood as being modified in all instances by the term "about." Accordingly, unless indicated to the contrary, the numerical parameters set forth in the specification and attached claims are approximations that can vary depending upon the desired properties sought to be obtained by those skilled in the art utilizing the teachings disclosed herein. The use of numerical ranges by endpoints includes all numbers within that range (e.g. 1 to 5 includes 1, 1.5, 2, 2.75, 3, 3.80, 4, and 5) and any range within that range.

As used herein, layers, components, or elements may be described as being adjacent one another. Layers, components, or elements can be adjacent one another by being in direct contact, by being connected through one or more other components, or by being held next to one another or attached to one another. Layers, components, or elements that are in direct contact may be described as being immediately adjacent.

One of the causes of network downtime is connections that work loose over time due to machine vibration, for example, or connections that are accidently knocked loose. A common Ethernet connector is the RJ (Registered Jack)-45 connector. Conventional RJ-45 connectors do not provide a mechanism for preventing accidental disconnection. The present description provides connectors which have a latch that may be substantially locked when the connector is placed into a mating connector thereby preventing accidental disconnection.

In some embodiments of the present description, a connector includes a first channel, a second channel and a latching member having a portion that is slidably attached to the first channel. The second channel is configured to move relative to the first channel so that the first channel and the

second channel can be aligned or misaligned. When the channels are aligned, a continuous channel is formed. In this case, the slidably attached portion of the latching member is free to move in the continuous channel and this allows the latching member to latch with and unlatch from a mating connector. When the channels are misaligned, the movement of the slidably attached portion of the latching member is restricted thereby preventing the latching member from latching with and unlatching from a mating connector. The connector may be used by placing the second channel in alignment with the first channel and inserting the connector into a mating connector causing the latching member to latch with the mating connector. The second channel may then be placed in misalignment with the first channel thereby preventing the latching member from accidently unlatching from the mating connector.

In some embodiments, the connector further includes a first body, which includes a mating end for mating with a mating connector, and a second body, which includes a rear end opposite the mating end for receiving a cable or cables. The first body includes the first channel which extends along a mating direction of the connector and the second body includes the second channel which extends along the mating direction. The second body may be adjacent to the first body and may be rotatably attached to the first body.

In some embodiments, the latching member further includes a fixed end that is fixedly attached to the first body proximate the mating end. The slidably attached portion of the latching member is a sliding end that is slidably attached to the first channel proximate the second body. An elongated latching arm joins the fixed end to the sliding end. The latching member also includes a latch portion extending from the latching arm for latching with and unlatching from a mating connector.

In some embodiments, the second body is configured to move relative to the first body between first and second states such that placing the second body in the first state aligns the second channel with the first channel and placing the second body in the second state misaligns the second channel with the first channel. For example, the second body may be configured to rotate along an axis substantially parallel to the mating direction and a first state may correspond to a zero degree rotation, while the second state may correspond to a 90 degree or a 180 degree rotation or some other non-zero rotation. When the second body is in the first state and the latching arm is pressed, the sliding end slides into the second channel allowing the latch portion to latch with and unlatch from a mating connector. When the second body is in the second state and the latching arm is pressed, the sliding end is prevented from entering the second channel because in this case the second channel is not aligned with the first channel. The latch portion is thereby prevented from latching with or unlatching from a mating connector when the first body is in the second state.

The connector may be an electrical connector, a fiber optic connector, an electro-optical connector or another type of connector that is capable of attaching a cable to a device, or one device to another device, for example. In some embodiments, the connector is an RJ-45 connector which may be in compliance with the ISO/IEC8877 standard, for example.

An embodiment of a connector of the present description is illustrated in FIGS. **1**A-**9**. FIG. **1**A is a perspective view of connector **1**. In the embodiment shown, connector **1** is an RJ-45 connector and is configured as a plug connector suitable for insertion into a mating connector. Connector **1** includes first body **10**, second body **110** and latching member **14** attached to first body **10**. First body **10** includes connector case **12** and mating component **16**. Connector case **12** also includes first channel **44** which includes first slide groove **48** and first slit **50**. Second body **110** includes second channel **144** which includes second slide groove **148** and second slit **150**. In FIG. **1**A, second body **110** is in a first state where first channel **44** and second channel **144** are aligned. FIG. **1**B shows connector **1**, with second body **110** in a second state where first channel **44** and second channel **144** are misaligned. FIG. **2** is a perspective view showing the lower side of the first body **10** of connector **1**. FIG. **3**A is a front view of second body **110** of connector **1**, FIG. **3**B is a cross-sectional view of second body **110** of connector **1**, and FIG. **3**C is a perspective view of second body **110** of connector **1**. Second body **110** includes snap-fit protrusions **130** and cable insertion opening **142**. Snap-fit protrusions **130** include ridge portions **135** and depressions **120**. FIG. **4** is a perspective view of mating component **16**. FIG. **5** is an exploded perspective view of connector **1**. FIG. **6** is a perspective view of mating component **16** and connector case **12**. FIGS. **7***a*, **7***b* and **7***c* are perspective views of latching member **14**. FIG. **8**A is a perspective view of a portion of first body **10** and FIG. **8**B is a perspective view of second body **110**. FIG. **9** is a perspective view of a partial cross-section of first body **10**.

An X,Y,Z coordinate system is defined in FIGS. **1**A-**2**. Connector **1** has a width in the X direction, a length in the Y direction and a height in the Z direction. The side of connector **1** that may be inserted into a plug insertion opening (not illustrated) of a mating connector (e.g., modular jack) is denoted as the "front" or "mating end" and the side in which a cable may be inserted is denoted as the "back" or "rear end". The "top" or "upper" side of connector refers to the side to which latching member **14** is attached and the "bottom" or "lower" side refers to the side opposite the top side. The mating direction is the Y-direction which is along a length of the connector between the mating and rear ends.

Connector **1** may be attached to a terminal of a cable (for example, cable **3** of FIG. **10**) which may be a communication cable, for example a LAN (local area network) cable having four core wires (for example, core wires **5** of FIG. **10**) and a shielding that covers an outer circumference of the core wires as a whole.

First body **10** is configured having a portion of mating component **16** housed in connector case **12** which includes an opening **40** into which a portion of mating component **16** is inserted. Mating component **16**, which is a portion of connector **1** that may be inserted into a target mating connector, includes assembly **17** and shielding member **18** which includes protruding portions **36***a* and **36***b* that engage with engagement portions **46** of connector case **12**. In the embodiment illustrated in FIGS. **1**A-**9**, connector case **12** is a first portion of first body **10** that has a larger cross-section in the X-Z plane than mating component **16** which is a second portion of first body **10**. The larger first portion (connector case **12**) is removably assembled to the smaller second portion (mating component **16**). The second portion includes mating end **20***a*.

Assembly **17** includes housing **20**, cable cover **22**, and contact members **24**. Housing **20** may be formed of a plastic material which may have electrically insulating properties. Suitable materials include polybutylene terephthalate (PBT) and polyamide (PA). Housing **20** includes encasing portion **26** and contact member holding portion **28**. Encasing portion **26**, which is provided on a back portion of housing **20**, encases and holds cable cover **22**. Locking portion **26***a* is provided on encasing portion **26** for locking cable cover **22**.

Housing **20** also includes mating end **20***a* which may be inserted into a mating connector.

Contact member holding portion **28** holds and fixes contact members **24**. Contact member holding portion **28** has a plurality (four in the illustrated embodiment) of groove portions **28***a* where contact members **24** are disposed. Groove portions **28***a* are provided from encasing portion **26** to mating end **20***a* of housing **20**. Groove portions **28***a* have shapes corresponding to the shapes of contact members **24**.

Cable cover **22** may be formed from a plastic material such as PBT, PA or the like. When a cable is attached, cable cover **22** encases the core wires of the cable. Cable cover **22** has a plurality (four in the illustrated embodiment) of insertion through holes **23** though which the core wires of a cable may be inserted. Insertion through holes **23** are disposed in the back end portion of cable cover **22** and are open to the rear side. In cable cover **22**, an opening (not illustrated) through which contacts **30** are inserted is provided in a position that corresponds to contacts **30** of contact members **24** when encased in encasing portion **26** of housing **20**.

A locking pawl **22***a* is provided on a side wall portion of cable cover **22**. Locking pawl **22***a* engages with locking portion **26***a* provided on encasing portion **26** of housing **20** thereby fixing cable cover **22** to housing **20**.

The number of contact members **24** included in assembly **17** is selected according to the number of wires in the cable (or cables) that is to be attached. In the embodiment shown, four contact members **24** are provided. Each of the contact members **24** are formed from a conductive material, such as metal (e.g., copper), or the like. Each of the contact members **24** includes a contact **30** and a contact terminal **32**. Contacts **30** may be disposed in encasing portion **26** in a staggered arrangement (see FIG. **10**, for example). Contacts **30** have a forked shape forming slits **30***a*. Inserting (e.g., pushing) the core wires into slits **30***a* of contacts **30** electrically connects the core wires to contacts **30** since contacts **30** cut into the cover of the core wires as they are inserted.

First body **10** includes a plurality of terminals (contact terminals **32**) configured to contact corresponding terminals of a mating connector. When connector **1** is inserted into a receptacle mating connector, contact terminals **32** make an electrical connection to each of the contacts of the receptacle mating connector. Contact terminals **32** are disposed in groove portions **28***a* of housing **20** and are exposed to the front end (i.e., mating end **20***a*) of housing **20**.

In some embodiments, shielding member **18** is constructed from a material having elastic or spring-like characteristics. Suitable materials include metals (e.g., aluminum or copper). Shielding member **18** partially encloses assembly **17** and provides an electrically conductive path between the receptacle mating connector and the shielding of an attached cable while also functioning as an electrostatic shield. Shielding member **18** includes base portion **18***a* and a pair of side wall portions **18***b* and **18***c* which are approximately perpendicular to base portion **18***a* and located on opposite sides of base portion **18***a*. A cross-section of shielding member **18** has an approximate U shape. Shielding member **18** also includes fixed element **34**, protruding portions **36***a* and **36***b*, and crimping portions **38***a* and **38***b*.

Fixed element **34** secures fixed end **60** (described elsewhere) of latching member **14**. Fixed element **34**, which is disposed on the front end side of shielding member **18**, has two fixed pieces, **34***a* and **34***b*, and a protruding piece **34***c*. The two fixed pieces **34***a* and **34***b* are disposed with a predetermined separation in the X direction and may be attached to or formed integrally with base portion **18***a* of shielding member **18**. Fixed pieces **34***a* and **34***b* have a cross-section in the Y-Z plane that appears as an approximate U shape and are folded back so as to open to the rear side (connector case **12** side).

Protruding piece **34***c* is disposed between the two fixed pieces **34***a* and **34***b*. Protruding piece **34***c* protrudes slightly upward toward the front side from a surface **18**S of base portion **18***a*. Protruding piece **34***c* engages with an indented portion **60***c* (described elsewhere) of latching member **14**. Fixed element **34** lifts the fixed end **60** of the latching member **14** by the protruding piece **34***c* to hold fixed end **60** by the two fixed pieces **34***a* and **34***b* which secures fixed end **60** of latching member **14** by the cooperation of the fixed pieces **34***a* and **34***b* and the protruding piece **34***c*.

Protruding portions **36***a* and **36***b* are disposed on the side wall portions **18***b* and **18***c*, respectively, toward the rear side of the shielding member **18**. Protruding portions **36***a* and **36***b* are plate-like members having a substantially rectangular shape. The back side (side facing connector case **12**) of protruding portions **36***a* and **36***b* are approximately flush with side wall portions **18***b* and **18***c* and the side facing mating end **20***a* protrude in the X direction so as to extend outward from the outer surface of the side wall portions **18***b* and **18***c*. Protruding portions **36***a* and **36***b* elastically deform when pressure is applied so that protruding portions **36***a* and **36***b* are pushed into the side wall portions **18***b* and **18***c*. When pressure is removed, protruding portions **36***a* and **36***b* then return to their original position.

Crimping portions **38***a* and **38***b* hold and fix a cable to first body **10** by crimping and fixing the cable thereby electrically connecting shielding member **18** to the shielding of the cable. The crimping portions **38***a* and **38***b* extend rearward from the side wall portions **18***b* and **18***c* and are mutually opposed.

In some embodiments, connector case **12** is formed of a plastic material having electrically insulating properties. Suitable materials include PBT, PA and the like. Using an electrically insulating material allows connector case **12** to be operated without interacting with any electrical charge that may be generated in shielding member **18** of assembly **17**.

Connector case **12** has a hollow substantially rectangular parallelepiped shape and includes an encasing space S to encase mating component **16**. Connector case **12** also includes an opening **40**, snap-fit portion **42**, first channel **44**, and engagement portions **46**. Back end portion **12***a* of connector case **12** faces front end portion **112***a* of second body **110**. In the embodiment illustrated in FIGS. **1**A-**9**, first channel **44** extends along the entire length of a first portion (connector case **12**) of first body **10**. In some embodiments, first channel **44** extends along only a portion of the length of first body **10** and in other embodiments, first channel **44** extends along an entire length of first body **10**. In the illustrated embodiment, when second body **110** is in the first state (shown in FIG. **1**A), second body **110** and a first portion (connector case **12**) of first body **10** have lateral cross-sections (i.e., cross-sections in the X-Z plane) having substantially the same size and shape.

Opening **40** in connector case **12** allows a portion of mating component **16** to be inserted into connector case **12**. Opening **40** has a shape substantially corresponding to the external shape of mating component **16**. In the embodiment shown, opening **40** has a substantially rectangular shape.

Snap-fit portion **42** accepts snap-fit protrusions **130** of second body **110** and provides an opening through which a cable or cables may be inserted. Snap-fit portion **42** is

provided on the back end portion **12***a* of the connector case **12**. In the illustrated embodiment, snap-fit portion **42** has a substantially circular shape.

Second body **110** includes cable insertion opening **142**, through which a cable or cables may be inserted, and snap-fit protrusions **130** which include ridge portions **135** and depressions **120**. Second body **110** may be rotatably attached to first body **10** by inserting snap-fit protrusions **130** into the opening provided by snap-fit portion **42**. In the illustrated embodiment, gaps are provided between separate snap-fit protrusions **130** so that snap-fit protrusions **130** can deform enough to allow assembly with snap-fit portion **42**. When assembled, snap-fit portion **42** is positioned in depressions **120** and ridge portions **135** prevents second body **110** from separating from first body **10**. The geometry may be chosen to provide friction between second body **110** and first body **10** so that some force is required to rotate second body **110** from a first state to a second state. This could be useful to prevent second body **110** from unintentionally shifting from a first state to a second state or vice versa.

Although in the embodiment illustrated in FIGS. **1A-9**, second body **110** includes snap-fit protrusions **130** and first body **10** includes an opening for accepting snap-fit protrusions **130**, in other embodiments first body **10** includes snap-fit protrusions while second body **110** includes an opening for accepting the snap-fit protrusions. The geometry of the snap-fit protrusions and snap-fit openings may also differ from the illustrated embodiment. For example, it is possible that the snap-fit opening is a ring-shaped slit (e.g., an annulus centered on a cable-insertion opening) rather than a circular opening. In this case, the snap-fit protrusions may have a tapered shape that produces a desired level of friction between first body **10** and second body **110** when inserted into the snap-fit opening. In another embodiment, a retaining ring is used to provide a rotatable connection between first body **10** and second body **110**. Retaining rings are known in the art and are available from W. W. Grainger, Inc., Lake Forest, Ill., for example. In this case, a slit can be made in snap-fit portion **42** for accepting a retaining ring and a groove can be provided on a protrusion on second body **110** that accepts the retaining ring. Alternatively, first body **10** may have a snap-fit protrusion with a groove for accepting a retaining ring located in a cavity provided in second body **110**. In still other embodiments, other types of rotatable connections between first body **10** and second body **110** are used. Suitable attachments methods include push-pull connector designs as described, for example, in U.S. Pat. No. 3,470,524 (Culver). The push-pull attachment can be designed so that second body **110** must be pulled away from first body **10** before it can be rotated and the first and second states.

In the embodiment illustrated in FIGS. **1A-9**, second body **110** can rotate to an arbitrary degree. In other embodiments, stops are provided on back end portion **12***a* of connector case **12** and front end portion **112***a* of second body **110** so that second body **110** can only rotate from about zero degrees (corresponding to a first state) to about 90 degrees or about 180 degrees (corresponding to a second state).

Engagement portions **46** engage with the protruding portions **36***a* and **36***b* provided on the shielding member **18** of first body **10**. Engagement portions **46**, which are provided on side wall portions **12***c* and **12***d*, respectively, towards the front end side of connector case **12**, are openings that pass through side wall portions **12***c* and **12***d*. Engagement portions **46** abut and engage with the tip end portions of the protruding portions **36***a* and **36***b* when first body **10** is inserted into connector case **12**. First body **10** and connector case **12** are removably attached by engagement portions **46** and protruding portions **36***a* and **36***b*. First body **10** can be removed from connector case **12** by pressing protruding portions **36***a* and **36***b*.

In the embodiment shown in FIGS. **1A-9**, the protruding portions **36***a* and **36***b* are provided on the shielding member **18** of mating component **16** and engagement portions **46** are provided on connector case **12**. In other embodiments, the openings (engagement portions) may be provided on shielding member **18** and the protruding portions may be provided on connector case **12**.

First channel **44** includes first slide groove **48** and first slit **50**. Sliding end **62** of latching member **14** is positioned in first slide groove **48**. First slide groove **48** is disposed above snap-fit portion **42** of the connector case **12** and open to back end portion **12***a*. First slide groove **48** has a bottom portion **48***a*, side portions **48***b* and **48***c*, and a top portion **48***d*. A cross-section of first slide groove **48** in the X-Z plane has a substantially rectangular shape. Similarly, second channel **144** includes second slide groove **148** and second slit **150**. Second slide groove **148** is disposed above cable insertion opening **142** of second body **110** and is open to front end portion **112***a*. Second slide groove **148** has a bottom portion **148***a*, side portions **148***b* and **148***c*, and a top portion **148***d*. A cross-section of second slide groove **148** in the X-Z plane when second body **110** is in the first state (see FIG. **1**A) has a substantially rectangular shape. Latching member **14** can move in first channel **44** when second body **110** is the first state. However, latching member **14** is restrained from moving in first channel **44** when second body **110** is in the second state (see FIG. **1**B).

Bottom portion **48***a* is above snap-fit portion **42** and is a flat portion that extends from the front end portion to the back end portion of connector case **12**. Top portion **48***d* constitutes the upper side portion of connector case **12** and opposes bottom portion **48***a*. The pair of side portions **48***b* and **48***c* extend in the Z direction from opposite sides of bottom portion **48***a* and link the bottom portion **48***a* and the top portion **48***d*.

First slide groove **48** has a first height H**1** between bottom portion **48***a* and top portion **48***d* on the back end side of connector case **12**, a second height H**2** between bottom portion **48***a* and top portion **48***d* on the front end side of the connector case **12**, a first width W**1** between the pair of side portions **48***b* and **48***c* on the back end side of connector case **12**, and a second width W**2** between the pair of side portions **48***b* and **48***c* on the front end side of connector case **12**. In some embodiments, the first and second heights are approximately equal (i.e., H**1**≈H**2**) and the first and second widths are approximately equal (i.e., W**1**≈W**2**) so that first slide groove **48** is a substantially constant space from the front end to the back end of the connector case **12**. The first and second heights H**1** and H**2** between bottom portion **48***a* and top portion **48***d* may be approximately equal to or slightly greater than the thickness of the sliding end **62** of the latching member **14**. The first and second widths W**1** and W**2** between the pair of side portions **48***b* and **48***c* may be approximately equal to or slightly greater than the width (dimension in the X direction) of sliding end **62** of latching member **14**. A suitable selection of the first and second heights, H**1** and H**2**, and the first and second widths, W**1** and W**2**, allow the movement of the sliding end **62** of the latching member **14** in first slide groove **48** to be restrained in the X direction (width direction) and in the Z direction (height direction) while allowing substantially free movement in the mating direction (Y direction) over a range when

second body **110** is in a first state so that second channel **144** is substantially aligned with first channel **44**.

Second slide groove **148** has a third height H**3** between bottom portion **148***a* and top portion **148***d* on the back end side of second body **110**, a fourth height H**4** between bottom portion **148***a* and top portion **148***d* on the front end side of second body **110**, a third width W**3** between the pair of side portions **148***b* and **148***c* on the back end side of second body **110**, and a fourth width W**4** between the pair of side portions **148***b* and **148***c* on the front end side of second body **110**. In some embodiments, the third and fourth heights are approximately equal (i.e., H**3**≈H**4**) and the third and fourth widths are approximately equal (i.e., W**3**≈W**4**) so that second slide groove **148** is a substantially constant space from the front end to the back end of second body **110**. The second and third heights H**3** and H**4** between bottom portion **148***a* and top portion **148***d* may be approximately equal to or slightly greater than the thickness of sliding end **62** of latching member **14**. The third and fourth widths W**3** and W**4** between the pair of side portions **148***b* and **148***c* may be approximately equal to or slightly greater than the width (dimension in the X direction) of sliding end **62** of latching member **14**.

A suitable selection of the third and fourth heights, H**3** and H**4**, and the third and fourth widths, W**3** and W**4**, allow the movement of the sliding end **62** to extend into second channel **144** when second body **110** is in a first state where second channel **144** is substantially aligned with first channel **44**. When second body **110** is in a second state where second channel **144** is misaligned with first channel **44**, then sliding end **62** of latching member **14** cannot extend into second channel **144**. When pressing portion **65** is pressed while second body **110** is in the second state, the movement of latching member **14** is thereby sufficiently restricted that that latch portion **66** is prevented from latching with or unlatching from a mating connector.

In the embodiment illustrated in FIGS. **1**A-**9**, first channel **44** and second channel **144** have lateral cross-sections (i.e., cross sections in the X-Z plane) having substantially the same size and shape and have geometries that satisfy the relationships H**1**≈H**2**≈H**3**≈H**4** and W**1**≈W**2**≈W**3**≈W**4**. When second body **110** is in a first state where first channel **44** and second channel **144** align, first channel **44** and second channel **144** form a substantially continuous channel. Second channel **144** has a lateral cross-section (i.e., cross-section in the X-Z plane) that is substantially the same as the lateral cross-section of first channel **44**. When second body **110** is in a first state where first channel **44** and second channel **144** align, first channel **44** and second channel **144** form a substantially continuous and uniform channel.

Configuring first channel **44** and second channel **144** to have a substantially constant space in the Y direction allows the sliding end **62** to slide smoothly. Further, this type of configuration may be preferred from the perspective of manufacturing connector **1**. Alternate geometries of the first and/or second channels may also be used. For example, the first and/or second slide groove may have a shape that tapers toward the front. In this case, the shape of the sliding end **62** may also be shaped to taper toward the fixed end **60**.

In the embodiment illustrated in FIGS. **1**A-**9**, second channel **144** extends through the length (dimension in the Y-direction) of second body **110**. In other embodiments, second channel **144** may extend only partway through the length of second body **110** and still allow enough movement of sliding end **62** when second channel **144** is aligned with first channel **44** so that latch portion **66** can latch with or unlatch from a mating connector.

First channel **44** also regulates movement in the mating direction (Y-direction) by providing stops which prevent latching member **14** from moving too far forward or backward in the Y-direction. First slide groove **48** includes first regulating portions **52***a* and **52***b* and second regulating portions **54***a* and **54***b* which regulate sliding in the mating direction of sliding end **62** of latching member **14**. First regulating portions **52***a* and **52***b* are disposed on the front end of first channel **44** at a predetermined distance in the X direction and connect bottom portion **48***a* and top portion **48***d*. First regulating portions **52***a* and **52***b* regulate the movement of the sliding end **62** in the forward direction by acting as stops preventing further forward movement.

Second regulating portions **54***a* and **54***b* are disposed further to the center portion in the Y direction of first slide groove **48** and are projections protruding from the pair of side portions **48***b* and **48***c*. Second regulating portions **54***a* and **54***b* regulate the movement of the sliding end **62** in the rearward direction. Sliding end **62** is disposed between first regulating portions **52***a* and **52***b* and second regulating portions **54***a* and **54***b* so that it can slide substantially freely. The distance between first regulating portions **52***a* and **52***b* and second regulating portions **54***a* and **54***b*, which is the maximum sliding distance of the sliding end **62** when second channel **144** is aligned with first channel **44**, may be, for example, less than 5 mm when the length in the Y direction of first body **10** is approximately from 20 to 40 mm. In some embodiments, the distance between the first regulating portions **52***a* and **52***b* and the second regulating portions **54***a* and **54***b* is approximately from 2 to 3 mm.

First slit **50** provides a passage that arm portion **64** of latching member **14** is allowed to pass through. In the embodiment illustrated in FIGS. **1**A-**9**, first slit **50** is disposed in top portion **48***d* of connector case **12** and forms a continuous open space with first slide groove **48**. First slit **50** extends in a belt-like shape in the Y direction at substantially the center in the X direction of the top portion **48***d*. In the illustrated embodiment, first slit **50** is formed from the front end to the back end of connector case **12**. The width of first slit **50** may be equal to or slightly greater than the width of the arm portion **64** of the latching member **14** thereby regulating the movement in the X direction of the arm portion **64**. Similarly, second slit **150** provides a passage for arm portion **64** of latching member **14** when second channel **144** is aligned with first channel **44**.

Latching member **14** includes fixed end **60**, sliding end **62**, arm portion **64**, and latch portion **66**. Fixed end **60** is attached to fixed element **34** of shielding member **18**. Latch portion **66** is adjacent fixed end **60** and arm portion **64** is adjacent latch portion **66** opposite fixed end **60**. Sliding end **62** is adjacent arm portion **64** opposite latch portion **66**.

Fixed end **60** is fixed to shielding member **18** of mating component **16**. Fixed end **60** has two side portions **60***a* and **60***b* that are inserted into and clamped by fixed pieces **34***a* and **34***b* of fixed element **34** of shielding member **18**, and indented portion **60***c* that is locked with protruding piece **34***c*. Side portions **60***a* and **60***b* are disposed with a prescribed spacing in the X direction (width). Indented portion **60***c* is positioned between side portion **60***a* and side portion **60***b* in the X direction and has a substantially rectangular shape. Fixed end **60** can be attached to and detached from the fixed element **34** of first body **10**.

Sliding end **62** is slidably attached to first channel **44** of connector case **12**. Sliding end **62** can be attached to and detached from first channel **44**. Sliding end **62** has an approximate U shape and includes a base portion **70** and first and second extension portions **71** and **72**. Base portion **70**

forms a plate-like shape that extends in the X direction and is linked to a first end portion (the end portion on the opposite side of the fixed end **60**) of the arm portion **64**. The arm portion **64** is linked at substantially the center portion of base portion **70**. The first and second extension portions **71** and **72** are provided on both end portions **70***a* and **70***b*, respectively, of base portion **70**.

First extension portion **71** is a plate-like member that extends from end portion **70***a* of base portion **70** to fixed end **60**. First extension portion **71** has a locking pawl **71***a* and an abutting portion **71***b*. Locking pawl **71***a* is provided on the tip end portion of first extension portion **71** and projects outward in the X direction. The tip end portion of first extension portion **71** is substantially L shaped due to locking pawl **71***a*. Abutting portion **71***b* is provided on the base end portion side of the first extension portion **71** oppose locking pawl **71***a* at a predetermined distance.

Similarly, second extension portion **72** extends from end portion **70***b* of base portion **70** to fixed end **60**. First extension portion **71** and second extension portion **72** extend from base portion **70** substantially in parallel. Second extension portion **72** has a locking pawl **72***a* and an abutting portion **72***b*. Locking pawl **72***a* is provided on the tip end portion of second extension portion **72** and projects outward in the X direction. The tip end portion of second extension portion **72** is substantially L shaped due to locking pawl **72***a*. Abutting portion **72***b* is provided on the base end portion side of the second extension portion **72** oppose locking pawl **72***a* at a predetermined distance.

As illustrated in FIG. **9**, when first and second extension portions **71** and **72** slide to the front end side in first channel **44**, the tip end portions abut first regulating portions **52***a* and **52***b* and the abutting portions **71***b* and **72***b* are locked into second regulating portions **54***a* and **54***b*. The movement of sliding end **62** is thus regulated in the forward Y direction by first regulating portions **52***a* and **52***b*, second regulating portions **54***a* and **54***b*, and first and second extension portions **71** and **72**. When second body **110** is in the first state and first and second extension portions **71** and **72** slide to the back end side in first channel **44**, locking pawls **71***a* and **72***a* lock in second regulating portions **54***a* and **54***b*. The movement of sliding end **62** is thus regulated in the backward Y direction by second regulating portions **54***a* and **54***b* and locking pawls **71***a* and **72***a*.

Arm portion **64** links fixed end **60** and sliding end **62**. Arm portion **64** may be an elongated member as shown in the illustrated embodiment and may have a degree of flexibility and elasticity. Arm portion **64** has an approximately downward facing U-shape when viewed from the X direction. In the embodiment shown, pressing portion **65** is provided on arm portion **64**. When using connector **1**, a user may press down on pressing portion **65** in order to operate latching member **14**.

Latch portion **66** is configured to engage with a mating connector. Latch portion **66** has a flat surface **67** in a substantially rectangular shape. Flat surface **67** extends in the X (width) direction and includes first portion **67***a*, which extends further outward in the X direction than first side portion **64***a* of arm portion **64**, and second portion **67***b*, which extends further outward in the X direction than second side portion **64***b* of arm portion **64**.

When removing connector **1** from a mating connector, pressing portion **65** provided on the arm portion **64** of the latching member **14** is pressed toward connector case **12**. If second channel **144** is aligned with first channel **44**, this pressing action slides sliding end **62** along first slide groove **48** while also moving arm portion **64** along first slit **50**. Sliding end **62** is allowed to slide into second channel **144** when second body **110** is in the first state. This movement causes latch portion **66** to lower toward connector case **12** and thereby releases the engagement between the mating connector and latch portion **66**. After the engagement between latch portion **66** and the receptacle connector is released, releasing the pressure applied to latching member **14** allows the sliding end **62** to slide to the front side (direction approaching the fixed end **60**) and return to the initial position (position depicted in FIG. **9**) due to the elasticity of arm portion **64** of latching member **14**.

If second body **110** is in a state where second channel **144** is misaligned with first channel **44**, sliding end **62** is substantially prevented from sliding into second channel **144** preventing latch portion **66** from lowering toward connector case **12** and thereby preventing the release of the engagement between the mating connector and latch portion **66** when a force is applied to pressing portion **65**.

A method of assembling connector **1** is illustrated in FIG. **10** and FIG. **11**. As illustrated in FIG. **10**, the terminal of cable **3** is first inserted into cable insertion opening **142** of second body **110** and then inserted into the opening provided by snap-fit portion **42** of connector case **12**. Sliding end **62** of latching member **14** is attached to first channel **44** of connector case **12** and second body **110** is attached to first body **10** by inserting snap-fit protrusions **130** into the opening provided by snap-fit portion **42**. Core wires **5** of cable **3** are then inserted into respective insertion through holes **23** of cable cover **22**.

Next, as illustrated in FIG. **11**A, cable cover **22** is encased in encasing portion **26** of housing **20** with core wires **5** of cable **3** held by cable cover **22**. When cable cover **22** is pushed into housing **20**, core wires **5** are pushed into contacts **30** of contact members **24** and the lead wires of core wires **5** are thereby electrically connected to contacts **30**. Subsequently, the crimping portions **38***a* and **38***b* of shielding member **18** are crimped to fix cable **3** to shielding member **18**.

Next, as illustrated in FIG. **11**B, connector case **12** and second body **110** are moved along cable **3** and connector case **12** is attached to shielding member **18**. Finally, as shown in FIG. **1**A, fixed end **60** of the latching member **14** is fixed to the fixed element **34** of shielding member **18**.

In the embodiment shown in FIGS. **10-11**, a single cable **3** is attached to connector **1**. In other embodiments, a plurality of cables may be attached to connector **1**. In this case, cable insertion opening **142** and snap-fit portion **42** may be formed according to the desired number of cables. For example, the diameter of the opening provided by snap-fit portion **42** may be selected so that a desired number of cables fit through the opening.

In addition to preventing accidental disconnection, the connectors of the present description also provide a reduced risk of failure compared to conventional connectors. In the embodiment illustrated in FIGS. **1A-9**, fixed end **60** is fixedly attached to first body **10** and sliding end **62** is slidably attached to first channel **44**. Therefore neither end portion of latching member **14** is free and as a result, the likelihood of failure of arm portion **64** due to catching on other articles or the like is low. The configuration where latching member **14** does not have a free end is also effective in reducing the size of connector **1** compared to conventional designs.

In the embodiment illustrated in FIGS. **1A-9**, first regulating portions **52***a* and **52***b* and second regulating portions **54***a* and **54***b* are provided in first slide groove **48** thereby regulating the movement of the sliding end **62** in the mating

(Y) direction. Therefore, the application of a large load to arm portion **64** will not cause sliding end **62** to move excessively, thereby reducing the likelihood of failure of latching member **14**.

The following is a list of embodiments of the present description:

Item 1 is a connector comprising:

a first body including:

a mating end of the connector for mating with a mating connector; and

a first channel extending along a mating direction of the connector;

a second body including:

a rear end of the connector opposite the mating end for receiving an cable; and a second channel extending along the mating direction; and

a latching member disposed along the mating direction and including:

a fixed end fixedly attached to the connector body proximate the mating end;

a sliding end slidably attached to the first channel proximate the rear end;

an elongated latching arm joining the fixed end to the sliding end; and

a latch portion extending from the latching arm for latching with and unlatching from a mating connector, the second body configured to move relative to the first body between first and second states, the second body in the first state aligns the second channel with the first channel so that when the latching arm is pressed the sliding end slides into the second channel allowing the latch portion to latch with and unlatch from a mating connector, the second body in the second state misaligns the second channel with the first channel so that when the latching arm is pressed the sliding end is prevented from sliding into the second channel preventing the latch portion from latching with and unlatching from a mating connector.

Item 2 is the connector of item 1, wherein the mating direction is along a length of the connector between the mating and rear ends.

Item 3 is the connector of item 1, wherein the first channel extends along only a portion of a length of the first body.

Item 4 is the connector of item 1, wherein the first channel extends along an entire length of the first body.

Item 5 is the connector of item 1, wherein the first body includes a larger first portion removably assembled to a smaller second portion, the second portion including the mating end.

Item 6 is the connector of item 5, wherein the first channel extends along an entire length of the first portion.

Item 7 is the connector of item 5, wherein when the second body is in the first state, the second body and the first portion have lateral cross-sections having substantially the same size and shape.

Item 8 is the connector of item 1, wherein the connector is an electrical connector.

Item 9 is the connector of item 8, wherein the first body includes a plurality of terminals configured to contact corresponding terminals of a mating connector.

Item 10 is the connector of item 1, wherein the connector is a fiber optic connector.

Item 11 is the connector of item 1, wherein when the second body is in the first state, the first and second channels form a substantially continuous channel.

Item 12 is the connector of item 1, wherein when the second body is in the first state, the first and second channels form a substantially continuous and uniform channel.

Item 13 is the connector of item 1, wherein the first and second channels have lateral cross-sections having substantially the same size and shape.

Item 14 is the connector of item 1, wherein the first body is adjacent the second body.

Item 15 is the connector of item 1, wherein the second body defines an opening extending therethrough for receiving a cable.

Item 16 is the connector of item 1, wherein the second body is configured to move between first and second states by rotating along an axis substantially parallel to the mating direction.

Item 17 is a connector comprising:

a first channel;

a latching member, a first portion of which is slidably attached to the first channel; and

a second channel configured to align with the first channel to form a substantially continuous channel to allow the latch member to latch with and unlatch from a mating connector, and to misalign with the first channel to prevent the latching member from latching with and unlatching from a mating connector.

Item 18 is the connector of item 17, wherein the connector is an electrical connector.

Item 19 is the connector of item 17, wherein the connector is a fiber optic connector.

Item 20 is the connector of item 17, wherein the first and second channels have lateral cross-sections having substantially the same size and shape.

Item 21 is the connector of item 17, further comprising a first body, the first body including the first channel, and a second body adjacent the first body, the second body including the second channel.

Item 22 is the connector of item 21, wherein the second body defines an opening extending therethrough for receiving a cable.

Item 23 is the connector of item 21, wherein the first channel extends along only a portion of a length of the first body.

Item 24 is the connector of item 21, wherein the first channel extends along an entire length of the first body.

Item 25 is the connector of item 21, wherein the first body is rotatably attached to the second body.

Item 26 is the connector of item 21, wherein the first body includes a larger first portion removably assembled to a smaller second portion, the second portion including a mating end.

Item 27 is the connector of item 26, wherein the first channel extends along an entire length of the first portion.

Item 28 is the connector of item 26, wherein when the second channel is aligned with the first channel, the second body and the first portion have lateral cross-sections having substantially the same size and shape.

Item 29 is the connector of item 21, wherein the latching member includes a second portion fixedly attached to the first body.

Item 30 is the connector of item 21, wherein the connector is an electrical connector.

Item 31 is the connector of item 30, wherein the first body includes a plurality of terminals configured to contact corresponding terminals of a mating connector.

Item 32 is the connector of item 21, wherein when the second body is in a first state, the first and second channels

align and when the second body is in a second state, the first and second channels misalign.

Item 33 is the connector of item 32, wherein the second body is configured to move between first and second states by rotating along an axis substantially parallel to a mating direction.

Item 34 is the connector of item 32, wherein when the second body is in the first state, the first and second channels form a substantially continuous and uniform channel.

Although specific embodiments have been illustrated and described herein, it will be appreciated by those of ordinary skill in the art that a variety of alternate and/or equivalent implementations can be substituted for the specific embodiments shown and described without departing from the scope of the present disclosure. This application is intended to cover any adaptations or variations of the specific embodiments discussed herein. Therefore, it is intended that this disclosure be limited only by the claims and the equivalents thereof.

What is claimed is:

1. A connector comprising:

a first body including:

a mating end of the connector for mating with a mating connector, and

a first channel extending along a mating direction of the connector;

a second body including:

a rear end of the connector opposite the mating end for receiving a cable, and

a second channel extending along the mating direction;

a latching member disposed along the mating direction and including:

a fixed end fixedly attached to the first body proximate the mating end,

a sliding end slidably attached to the first channel proximate the rear end, and

an elongated latching arm joining the fixed end to the sliding end; and

a latch portion extending from the latching arm for latching with and unlatching from a mating connector, the second body configured to move relative to the first body between first and second states, the second body in the first state aligns the second channel with the first channel so that when the latching arm is pressed the sliding end slides into the second channel allowing the latch portion to latch with and unlatch from a mating connector, the second body in the second state misaligns the second channel with the first channel so that when the latching arm is pressed the sliding end is prevented from sliding into the second channel preventing the latch portion from latching with and unlatching from a mating connector.

2. The connector of claim **1**, wherein the mating direction is along a length of the connector between the mating and rear ends.

3. The connector of claim **1**, wherein the first channel extends along only a portion of a length of the first body.

4. The connector of claim **1**, wherein the first channel extends along an entire length of the first body.

5. The connector of claim **1**, wherein the first body includes a larger first portion removably assembled to a smaller second portion, the second portion including the mating end.

6. The connector of claim **5**, wherein the first channel extends along an entire length of the first portion.

7. The connector of claim **5**, wherein when the second body is in the first state, the second body and the first portion have lateral cross-sections having substantially the same size and shape.

8. The connector of claim **1**, wherein the connector is an electrical connector.

9. The connector of claim **8**, wherein the first body includes a plurality of terminals configured to contact corresponding terminals of a mating connector.

10. The connector of claim **1**, wherein the connector is a fiber optic connector.

11. The connector of claim **1**, wherein when the second body is in the first state, the first and second channels form a substantially continuous channel.

12. The connector of claim **1**, wherein when the second body is in the first state, the first and second channels form a substantially continuous and uniform channel.

13. The connector of claim **1**, wherein the first and second channels have lateral cross-sections having substantially the same size and shape.

14. The connector of claim **1**, wherein the first body is adjacent the second body.

15. The connector of claim **1**, wherein the second body defines an opening extending therethrough for receiving a cable.

16. The connector of claim **1**, wherein the second body is configured to move between first and second states by rotating along an axis substantially parallel to the mating direction.

17. A connector comprising:

a first channel,

a latching member, a first portion of which is slidably attached to the first channel, and

a second channel configured to align with the first channel to form a substantially continuous channel to allow the latching member to latch with and unlatch from a mating connector, and to misalign with the first channel to prevent the latching member from latching with and unlatching from a mating connector,

wherein the first and second channels have lateral cross-sections having substantially the same size and shape.

18. The connector of claim **17**, wherein the connector is an electrical connector.

19. The connector of claim **17**, wherein the connector is a fiber optic connector.

20. The connector of claim **17**, further comprising a first body, the first body including the first channel, and a second body adjacent the first body, the second body including the second channel.

21. The connector of claim **20**, wherein the second body defines an opening extending therethrough for receiving a cable.

22. The connector of claim **20**, wherein the first channel extends along only a portion of a length of the first body.

23. The connector of claim **20**, wherein the first channel extends along an entire length of the first body.

24. The connector of claim **20**, wherein the first body is rotatably attached to the second body.

25. The connector of claim **20**, wherein the first body includes a larger first portion removably assembled to a smaller second portion, the second portion including a mating end.

26. The connector of claim **25**, wherein the first channel extends along an entire length of the first portion.

27. The connector of claim **25**, wherein when the second channel is aligned with the first channel, the second body

and the first portion have lateral cross-sections having substantially the same size and shape.

28. The connector of claim **20**, wherein the latching member includes a second portion fixedly attached to the first body.

29. The connector of claim **20**, wherein the connector is an electrical connector, and wherein the first body includes a plurality of terminals configured to contact corresponding terminals of a mating connector.

30. The connector of claim **20**, wherein when the second body is in a first state, the first and second channels align and when the second body is in a second state, the first and second channels misalign.

31. The connector of claim **30**, wherein the second body is configured to move between first and second states by rotating along an axis substantially parallel to a mating direction.

32. The connector of claim **30**, wherein when the second body is in the first state, the first and second channels form a substantially continuous and uniform channel.

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